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AEROTECHNOLOGY
PRELIMINARY DATA

CHARACTERISTICS OF MSC ORBITER
OF REYNOLDS NUMBER AND
CORNER WIND AT $M \leq 0.5$

DATA PREPARED BY ENGINEER
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Armed Forces Division, ARO, Inc.
Contract No. NAS2-5235

This document contains preliminary data and should not be referenced in formal publications.

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SUMMARY

The effects of Reynolds number and body corner radius on the aerodynamic characteristics of a model of the proposed MSC Space Shuttle Orbiter have been investigated and the results are presented. The model, a modified May 1969 baseline shape, was tested in the Ames 12-Foot Pressure Wind Tunnel during November 1969.

INTRODUCTION

An exploratory investigation of the aerodynamic characteristics of the proposed MSC Space Shuttle Orbiter was conducted in the Ames 6- by 6-Foot Wind Tunnel and the results reported in reference 1. It was suspected that the subsonic data for the orbiter at large angles of attack may be a strong function of the body corner radius and the test Reynolds number; hence, that the results may not be representative of full scale flight. This suspicion was based upon experimental data for two-dimensional non-circular cylinders (reference 2) which showed that the cross flow and resultant forces changed rapidly at a critical Reynolds number -- the value of this critical Reynolds number being strongly dependent on cylinder corner radius. A further investigation of the orbiter was undertaken, therefore, to determine the effects of Reynolds number and corner radius on the aerodynamic characteristics at high angles of attack. The results are presented herein without analysis to expedite release of the data.

The investigation was conducted in the Ames 12-Foot Pressure Wind Tunnel during November 1969, (Test No. 12-464). The range of test conditions included Mach numbers of 0.3 to 0.5 (most of tests were limited to 0.3), Reynolds numbers of 1.4×10^6 to 8.7×10^6 per foot, angles of attack from -6 to 75 degrees, and angles of sideslip from -10 to 9 degrees. Except for modifications to allow changes in corner radius, the model was the same as that investigated in reference 1.

SYMBOLS

All moments have been calculated for the moment center location shown on Figure 4.

b	wing span, 1.50 ft
c	wing mean aerodynamic chord, 0.2317 ft
C_A	body axis axial-force coefficient, axial force/ $q_\infty S$
C_D	stability axis drag coefficient, drag/ $q_\infty S$
C'_D	stability axis drag coefficient uncorrected for tunnel wall interference
C_L	stability axis lift coefficient, lift/ $q_\infty S$
L/D	lift-to-drag ratio, lift/drag
C_r	body axis rolling moment coefficient, rolling moment/ $q_\infty S b$

C_m	stability and body axis pitching moment coefficient, pitching moment/ $\frac{q_\infty}{2} S \bar{c}$
C'_m	pitching-moment coefficient uncorrected for tunnel wall interference
C_N	body axis normal-force coefficient, normal force/ $\frac{q_\infty}{2} S$
C_{N_2}	body axis normal force coefficient, normal force/ $\frac{q_\infty}{2} S_2$
C_n	body axis yawing-moment coefficient, yawing moment/ $\frac{q_\infty}{2} S_b$
C_Y	stability and body axis side force coefficient, side force/ $\frac{q_\infty}{2} S$
D	drag, lb
M_∞	free-stream Mach number
M'_∞	tunnel Mach number uncorrected for blockage
q_∞	free-stream dynamic pressure, psf
q'_∞	measured dynamic pressure uncorrected for blockage and tunnel calibration, psf
R	Reynolds number, millions per foot
r	body lower corner radius, inches
S	wing reference area, 0.32 ft^2 , includes area formed by extending leading and trailing edges to body centerline
S_2	planform area of body with zero lower corner radius, 0.62 ft^2
α	angle of attack of model horizontal reference plane, degrees
α'	angle of attack uncorrected for tunnel wall interference
β	angle of sideslip of the model vertical reference plane, degrees
δ_{ih}	elevator deflection angle, positive, trailing edge down, degrees
θ	angle between model horizontal reference plane and the wing centerline, degrees
Λ	sweep angle, degrees

MODEL NOTATION

B body. Subscripts identify bodies with different lower surface corner radii, e.g.,

<u>Subscript</u>	<u>Radius</u>
3	0.0 inches
5	1/3 local body width
6	0.16 inches
7	0.24 inches
8	0.34 inches
10	0.24 inches (forward of wing) 0.0 inches (aft of wing)
B.L.	model buttock line, inches
*H ₅	horizontal stabilizer (Figure 6)
H ₈	horizontal stabilizer (Figure 6)
M.S.	model station, inches
V ₄	vertical stabilizer (Figure 7)
W ₁	wing (Figure 5)

*Fixed horizontal tail extension installed with H₅ (see Figure 4).

APPARATUS AND METHOD

This investigation was conducted in the 12-Foot Pressure Wind Tunnel in order to provide the required Reynolds numbers.

The model was an 0.02-scale version of the proposed Manned Spacecraft Center Space Shuttle orbiter May 1969 baseline modified to approximate August 15, 1969 baseline. Sketches of the model are shown in Figures 1 through 7 and photographs of the model are shown in Figure 8. Principal dimensions and areas of the model are presented in Table I.

The model was the same as that investigated in reference 1 except that it was modified to allow for a change in the body lower surface corner radius. Corner radii, r, investigated were 0, 0.16, 0.24, 0.34 inch and a varying radius equal to 1/3 the body width at that body station. In addition, the effect of two horizontal tails, H₅ and H₈ was also investigated.

The model was sting mounted as shown in Figures 1 through 3. The sting entered the base of the model at $\theta = 0$ and 8 degrees and entered through the top of the model at $\theta = 36$ degrees. Three sting-to-model angle relationships were required to cover the angle-of-attack and angle-of-sideslip ranges.

MEASUREMENTS AND CORRECTIONS

Aerodynamic forces and moments were measured with six-component, internal, strain gage balances; a 1½ inch and a 2.0 inch were used for runs 4 through 14 and 15 through 114, respectively. Forces and moments were corrected for base and model cavity pressures.

¹ Shown with fixed horizontal tail extension removed.

The angle of attack was measured using an angle transducer mounted on the support system. Sting and balance deflection corrections were applied.

The data were corrected for interference from the tunnel walls as follows:

$$\alpha = \alpha' + .021 C_L$$

$$C_D = C_D' + .000125 C_L^2$$

$$C_m = C_m' + .000056 C_L \quad \text{horizontal stabilizer on}$$

$$C_m = C_m' \quad \text{horizontal stabilizer off}$$

The corrections applied to the free-stream Mach number for model blockage were determined as follows:

$$M_\infty = M_\infty' \left[1 + K \left[1 + 0.2(M_\infty')^2 \right] \right]$$

$$K = \frac{0.0001168}{\left[1 - (M_\infty')^2 \right]^{\frac{3}{2}}} + 0.0023148 \left[\frac{1 + 0.4(M_\infty')^2}{1 - (M_\infty')^2} \right] \frac{D}{q'}$$

The bump on the wind-tunnel floor (Figure 1), housing part of the model support system, introduced flow angularity in the test section. The magnitude of the flow angle was of the order of 1 to 2 degrees in the vicinity of the model when the model was at zero angle of attack. With increasing angle of attack the model moved away from the bump into a region where flow angularity diminished in magnitude and importance. No correction was applied to the data.

PRESENTATION AND RESULTS

Table II is an index of the data figures presented and Table III is an index of completed runs. The longitudinal characteristics are presented in Figures 9 through 34 and the lateral characteristics in Figures 35 through 48. The data were machine-faired using straight line elements.

REFERENCES

1. Brownson, Jack J.: Static Stability Characteristics of MSC Orbiter: Preliminary Tests at Mach No. 0.25-2.0. Ames Space Shuttle Preliminary Data Report, SSPD-1, December 22, 1969.
2. Polhamus, Edward C.: Effect of Flow Incidence and Reynolds Number on Low-Speed Aerodynamic Characteristics of Several Nonsircular Cylinders with Applications to Directional Stability and Spinning. NASA TR R-29, 1959.

TABLE I MODEL GEOMETRY

	Wing W ₁	Vertical Stabilizer V ₄	Horizontal Stabilizers H ₅ H ₈
Area, ft ²	0.322*	0.089	0.257*
Deflected Area, ft ²	-	-	0.131
Span, ft	1.500	0.361	0.954
Aspect Ratio	6.988	1.464	3.541
Mean Aerodynamic Chord, ft	0.232	0.255	0.280
Root Chord, ft	0.320	0.342	0.362
Leading Edge), Degrees	24.05	35.00	21.22
(Trailing Edge), Degrees	-1.83	9.85	0.00

Dimensions indicated area, thickness 30% and for H₅ includes fixed horizontal tail extension.

TABLE II INDEX OF DATA FIGURES

Figure	Parameter	Title
9 10 11 12 13	$R = 7.5$ $R = 5.5$ $R = 3.8$ $R = 1.9$ $R = 7.5$	Effect of angle of attack on longitudinal characteristics with various body corner radii for body only configuration.
14 15 16 17	B_3 B_6 B_7 B_8	Effect of angle of attack on longitudinal characteristics with various body corner radii for complete model configuration.
18 19 20 21 22 23	$B_5 W_1 H_5$ $B_7 W_1$ $B_7 W_1 H_5$ $B_7 W_1 H_8$ $B_8 W_1 H_5$ $B_{10} W_1 H_5$	Effect of angle of attack on longitudinal characteristics at various Reynolds numbers for body only configuration.
24 25 26	$B_7 W_1 H_5$ $B_7 W_1 H_8$ $B_8 W_1 H_5$	Effect of angle of attack on longitudinal characteristics at various Reynolds numbers for several model configurations.
27	$R = 7.5$	Effect of angle of attack on longitudinal characteristics during model buildup, $R = 7.5$.
28 29	$R = 7.5$ $R = 1.9$	Effect of angle of attack on longitudinal characteristics for various horizontal stabilizer configurations with body B_7 .
30 31	$R = 7.5$ $R = 1.9$	Effect of angle of attack on longitudinal characteristics for various elevator deflection angles, $B_7 W_1 H_8$.
32	$B_7 W_1 H_5$	Variation of longitudinal characteristics with Mach number.
33	$\alpha = 60$	Variation of normal force with Reynolds number for body only configuration.
34	$\alpha = 60$	Variation of pitching moment with Reynolds number for body only configuration.
35 36	$R = 7.5$ $R = 1.9$	Effect of sideslip angle on lateral characteristics with various body corner radii for body only configuration, $\alpha = 60$ degrees.

TABLE II (Concluded)

Figure	Parameter	Title
37	$R = 7.5$	Effect of sideslip angle on lateral characteristics with various body corner radii for complete model configuration, $\alpha = 60$ degrees.
38	B_8	Effect of sideslip angle on lateral characteristics at various Reynolds numbers, $\alpha = 0$ degrees.
39	B_3	
40	B_6	
41	B_7	
42	B_8	
43	$B_5 W_1 H_5$	
44	$B_7 W_1$	
45	$B_7 W_1 H_5$	Effect of sideslip angle on lateral characteristics at various Reynolds numbers for several model configurations, $\alpha = 60$ degrees.
46	$B_7 W_1 H_8$	
47	$B_8 W_1 H_5$	
48	$B_{10} W_1 H_5$	
49	$R = 7.5$	Effect of sideslip angle on lateral characteristics during model buildup with body B_8 , $\alpha = 6$ degrees.
50	$B_7 W_1 H_5$	
51	$B_7 W_1 H_8$	Effect of sideslip angle on lateral characteristics during model buildup, $\alpha = 60$ degrees, $R = 7.5$.
52	$B_8 W_1 H_5$	
53	$R = 7.5$	Effect of sideslip angle on lateral characteristics for various horizontal stabilizer configurations with body B_7 , $\alpha = 60$ degrees.
54	$B_7 W_1 H_5$	Variation of lateral characteristics with Mach number.

TABLE III INDEX OF RUNS

RUN	CONF	M_∞	P	α	β	θ	δ_{i_h}	REMARKS
1	B ₃	Vary	7.5	Vary	0		-	
2		.30					-	
3	B ₃						-	
4	B ₈ W ₁ H ₅ V ₄			Vary	0		0	
5			7.5	6	Vary			
6			4.9	Vary	0			
7	B ₈ W ₁ H ₅ V ₄		1.9	Vary	0		0	
8	B ₈ W ₁		7.5	Vary	0		-	
9			7.5	6	Vary		-	
10	B ₈ W ₁		1.9	Vary	0		-	
11	B ₈		7.5	Vary	0		-	
12			7.5	0	Vary		-	
13			1.9	Vary	0		-	
14		.30	1.9	0	Vary		0	
15		Vary	Vary	60	0		36	
16		.30	7.5	Vary	0		-	
17			7.5	60	Vary		-	
18			5.5	Vary	0		-	
19		.30	5.5	60	Vary		-	
20		Vary	Vary	60	0		-	
21		.30	3.8	Vary	0		-	
22		.30	3.8	60	Vary		-	
23		Vary	Vary	60	0		-	
24		.30	1.9	Vary	0		-	
25	B ₈	.30	1.9	60	Vary		-	
26	B ₆	Vary	Vary	60	0		-	
27		Vary	Vary	70	0		-	
28		.30	7.5	Vary	0		-	
29			7.5	60	Vary		-	
30			5.5	Vary	0		-	
31		.30	5.5	60	Vary		-	
32		Vary	Vary	60	0		-	
33		Vary	Vary	70	0		-	
34	B ₆	.30	3.8	Vary	0		-	

TABLE III INDEX OF RUNS (Continued)

RUN	CONF	M_{∞}	R	α	β	θ	δ_{1h}	REMARKS
35	B ₆	.30	3.8	60	Vary	36	-	
36	B ₆	.30	1.9	Vary	0		-	
37	B ₆	.30	1.9	60	Vary		-	
38	B ₇	Vary	Vary	60	0		-	
39	B ₇	Vary	Vary	70		↓	-	
40	B ₇	.30	7.5	Vary	0	36	-	
41	B ₇		7.5	60	Vary		-	
42	B ₇		5.5	Vary	0		-	
43	B ₇	.30	5.5	60	Vary		-	
44	B ₇	Vary	Vary	60	0		-	
45	B ₇	Vary	Vary	70		↓	-	
46	B ₇	.30	3.8	Vary	0		-	
47	B ₇		3.8	60	Vary		-	
48	B ₇		1.9	Vary	0		-	
49	B ₇	.30	1.9	60	Vary		-	
50	B ₃	Vary	Vary	60	0		-	
51	B ₃	.30	7.5	Vary	0		-	
52	B ₃		7.5	60	Vary		-	
53	B ₃		5.5	Vary	0		-	
54	B ₃		3.8		↓	0	-	
55	B ₃		1.9	Vary	0		-	
56	B ₃	.30	1.9	60	Vary		-	
57	B _{7W1}	Vary	Vary	60	0		-	
58	B _{7W1}	.30	7.5	Vary	0		-	
59	B _{7W1}	.30	7.5	60	Vary		-	
60	B _{7W1}	Vary	Vary	60	2		-	
61	B _{7W1}	.30	1.9	Vary	0		-	
62	B _{7W1}	.30	1.9	60	Vary		-	
63	B _{7W1H5}	Vary	Vary	60	0		0	
64	B _{7W1H5}	.30	7.5	Vary	0		0	
65	B _{7W1H5}	.30	7.5	60	Vary		0	
66	B _{7W1H5}	Vary	Vary	60	2		0	
67	B _{7W1H5}	.30	1.9	Vary	0	36	0	

TABLE III INDEX OF RUNS (Continued)

RUN	CONF	M_{∞}	R	α	β	θ	δ_{i_h}	REMARKS
68	B ₇ W ₁ H ₅	.30	1.9	60	Vary	36	0	
69			7.5	Vary	0		30	
70			7.5	60	Vary			
71			1.9	Vary	0			
72			1.9	60	Vary		30	
73			7.5	Vary	0		-10	
74		.30	1.9				-10	
75		.53	2.9	Vary	0		0	
76		.53	2.9	60	Vary			
77		.42	3.8	Vary	0			
78	B ₇ W ₁ H ₅	.42	3.8	60	Vary			
79	B ₁₀ W ₁ H ₅	.30	7.5	Vary	0			
80	B ₁₀ W ₁ H ₅	.30	7.5	60	Vary			
81	B ₁₀ W ₁ H ₅		1.9	Vary	0			
82	B ₁₀ W ₁ H ₅		1.9	60	Vary			
83	B ₅ W ₁ H ₅		7.5	Vary	0			
84			7.5	60	Vary			
85			1.9	Vary	0			
86	B ₅ W ₁ H ₅		1.9	60	Vary			
87	B ₈ W ₁ H ₅		7.5	Vary	0			
88			7.5	60	Vary			
89			1.9	Vary	0			
90	B ₈ W ₁ H ₅		1.9	60	Vary		0	
91	B ₈ W ₁		7.5	Vary	0			
92			7.5	60	Vary			
93			1.9	Vary	0			
94	B ₈ W ₁		1.9	60	Vary			
95	B ₇ W ₁ H ₈		7.5	Vary	0		0	
96			7.5	60	Vary			
97			1.9	Vary	0			
98			1.9	60	Vary		0	
99			7.5	Vary	0		30	
100	B ₇ W ₁ H ₈	.30	7.5	60	Vary	36	30	

TABLE III INDEX OF RUNS

(Concluded)

RUN	CONF	M_{∞}	R	α	β	θ	δ_{ih}	REMARKS
101	B ₇ W ₁ H ₈	.30	1.9	Vary	0	36	30	
102			1.9	60	Vary		30	
103			7.5	Vary	0		-30	
104			7.5	60	Vary			
105			1.9	Vary	0	36		
106	B ₇ W ₁ H ₈		1.9	60	Vary	36	-30	
107	B ₇ W ₁ H ₈ V ₄		7.5	Vary	0	8	0	
108			7.5	6	Vary			
109			1.9	Vary	0			
110			1.9	2	Vary			
111			7.5	Vary	0			
112			7.5	6	Vary			
113			1.9	Vary	0	36		
114	B ₇ W ₁ H ₈ V ₄	.30	1.9	6	Vary	8	0	Model Inverted

All Dimensions in Inches Unless Otherwise Noted

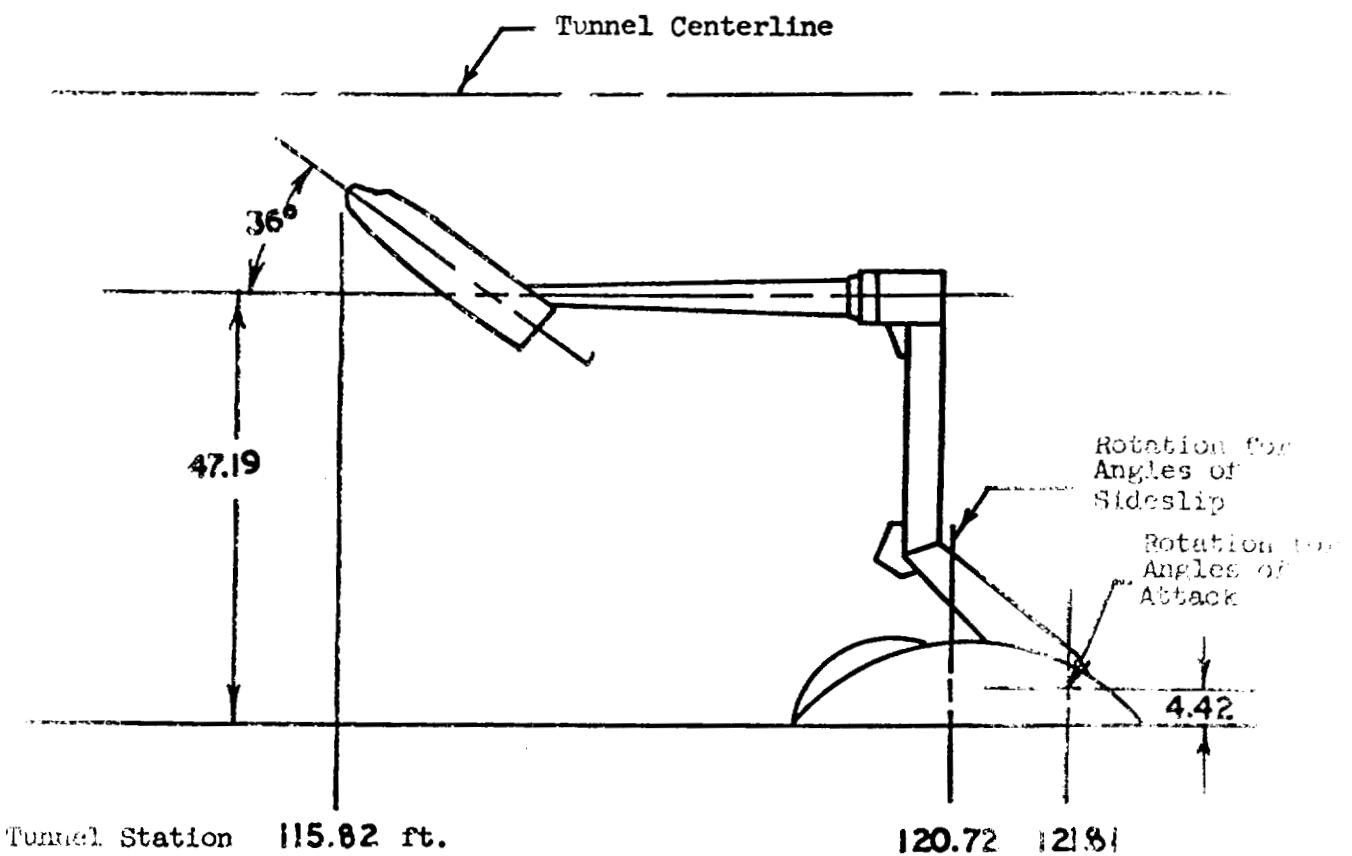


Figure 1.- Model Location in the Ames 12-Foot Pressure Wind Tunnel, 9:36 Deg/mo

All Dimensions in Inches Unless Otherwise Noted

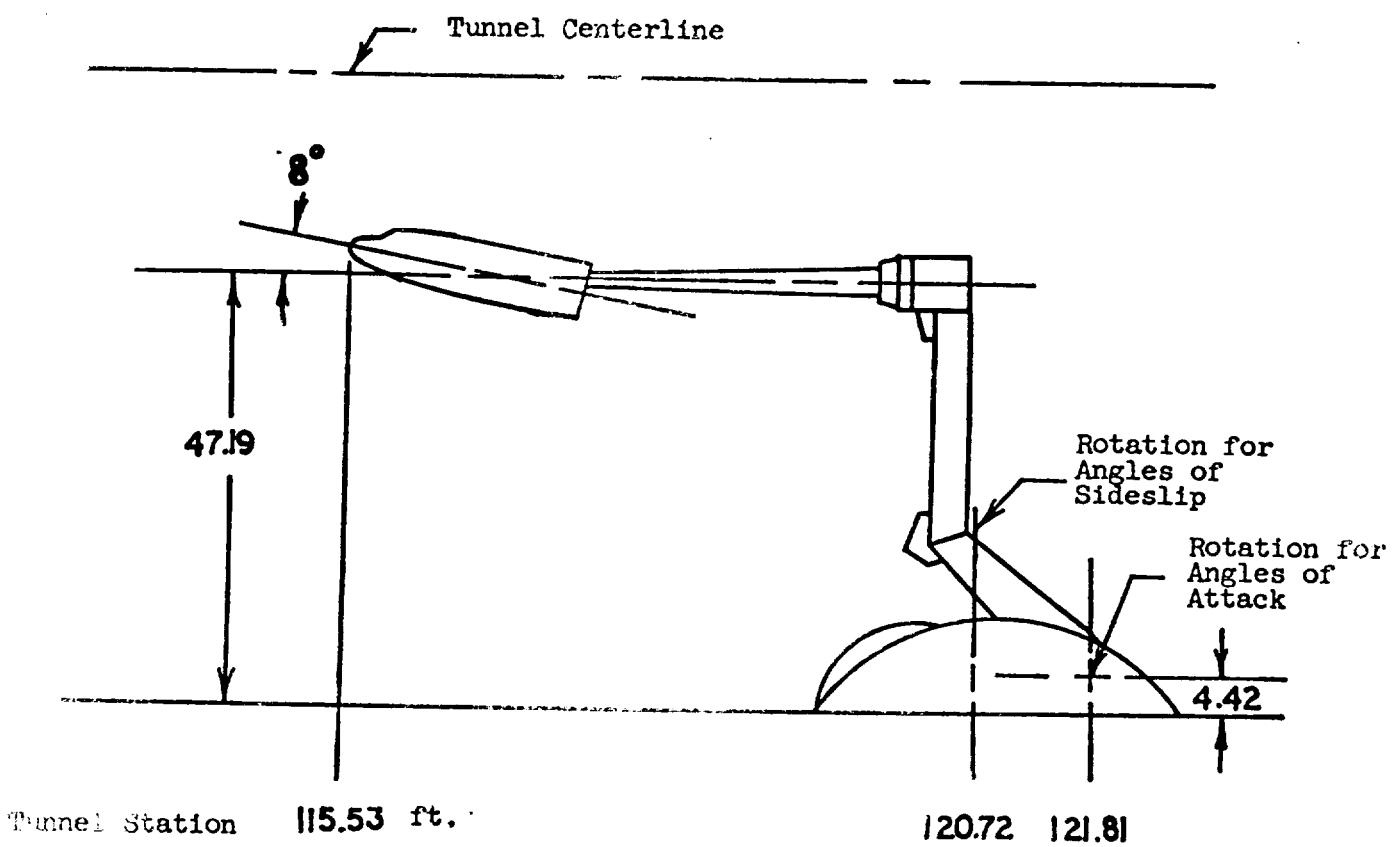


FIGURE 2.-Model Location in the Ames 12-Foot Pressure Wind Tunnel, $\theta=8$ Degrees

All Dimensions in Inches Unless Otherwise Noted

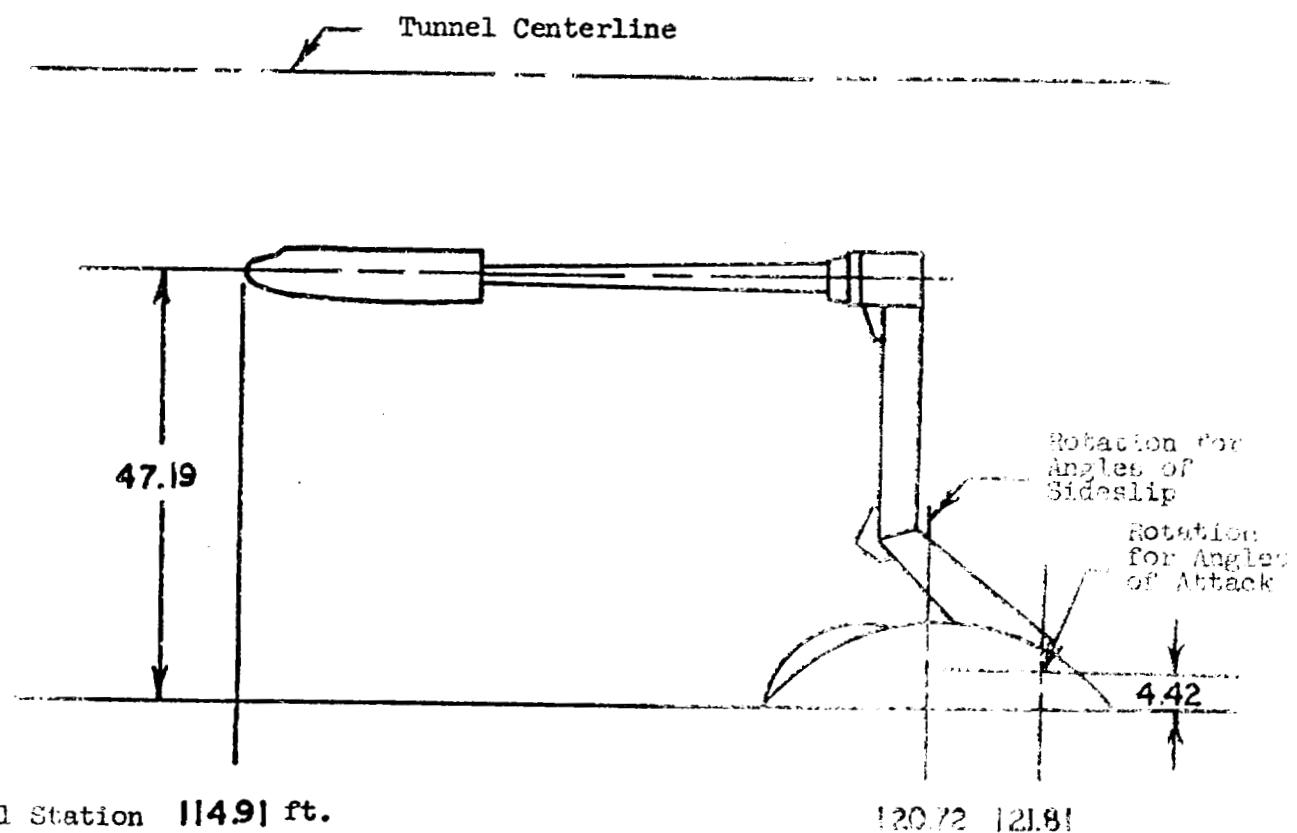


Figure 3.- Model Location in the Ames 12-Foot Pressure Wind Tunnel, 0-0 Degress

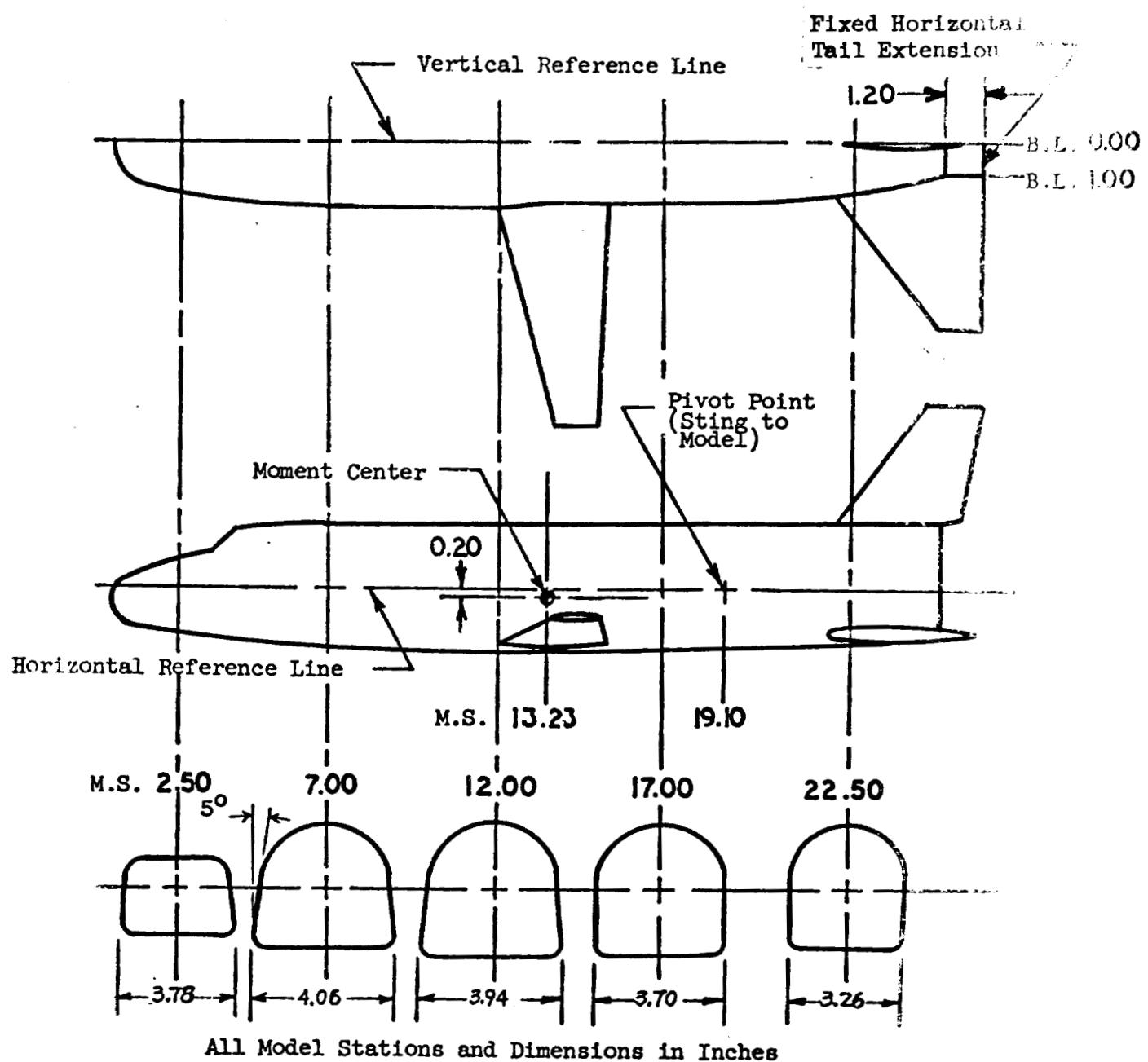
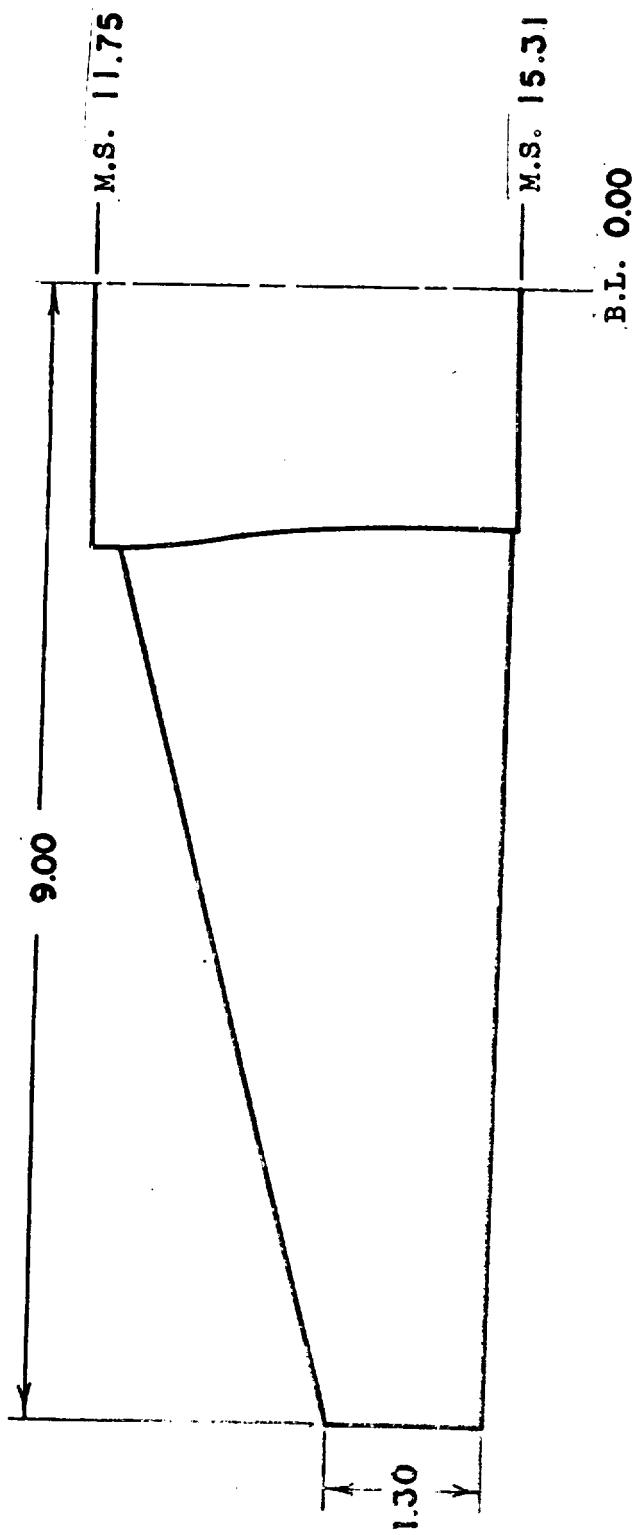


Figure 4.-Plan and Elevation View of Model



All Dimensions in Inches

Figure 5.-Planform of Wing W_1

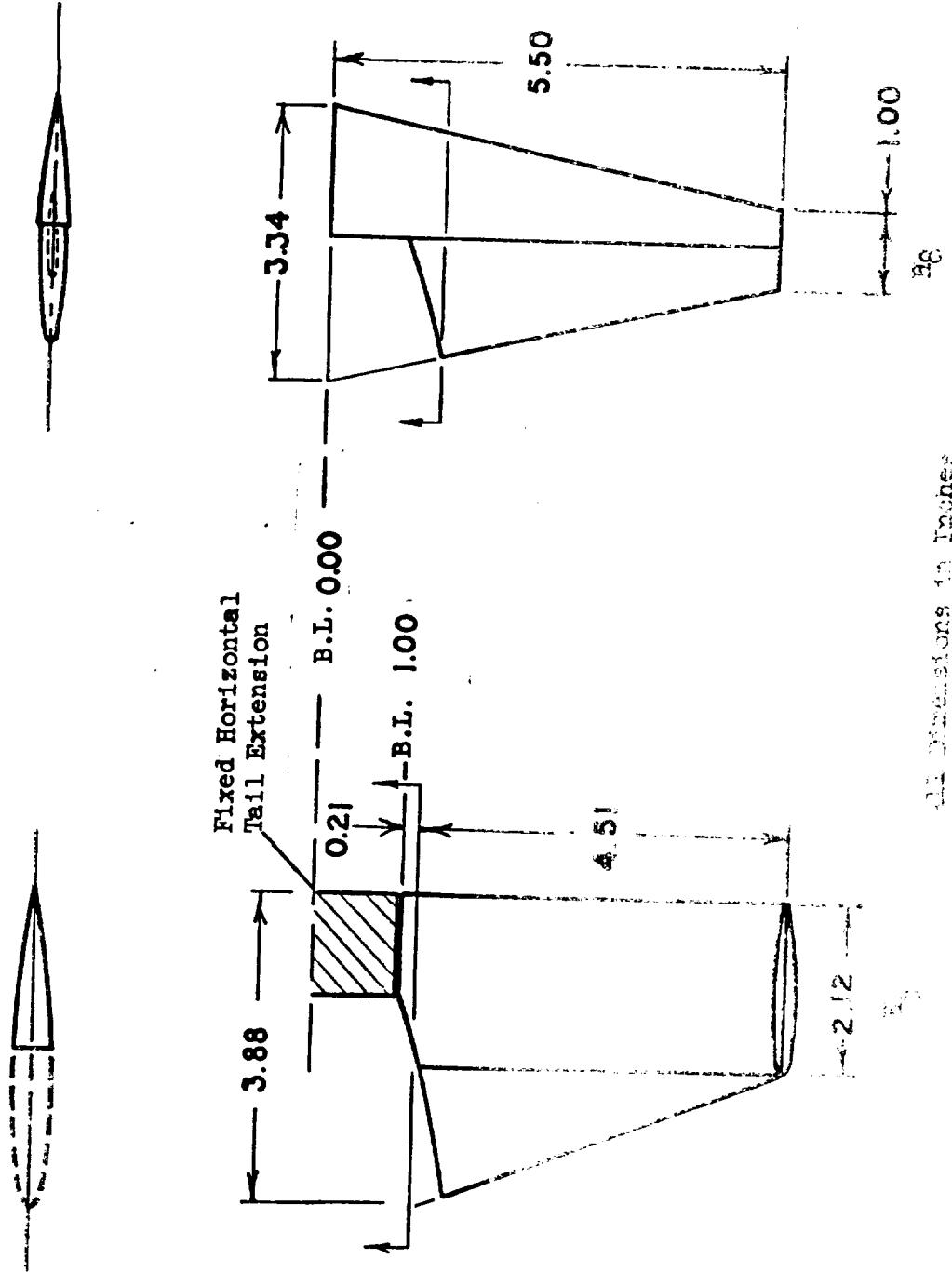
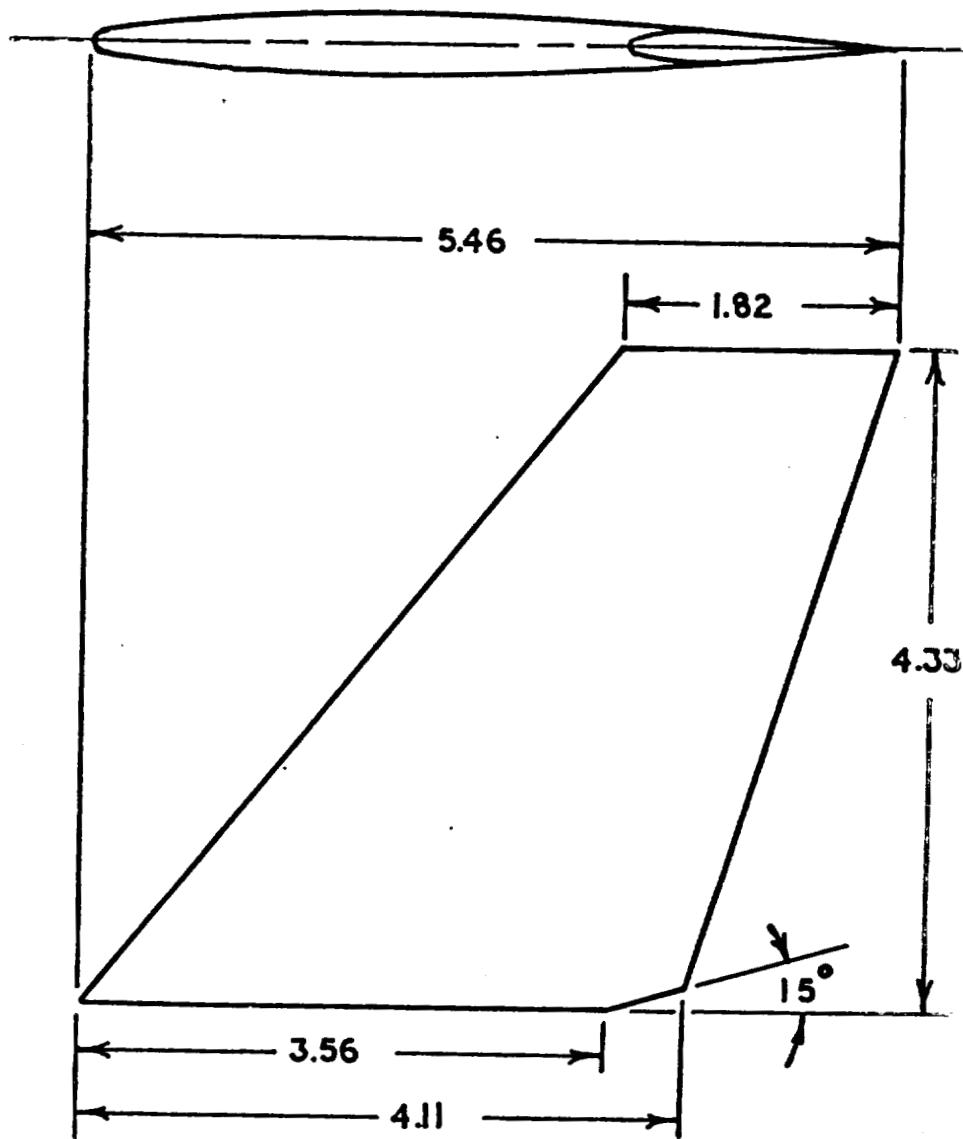


FIGURE 6 - Horizontal Stabilizers E₁ and E₂



All Dimensions in Inches

Figure 7.- Vertical Stabilizer V₄



(a) Model installation in the Ames 12-Foot Pressure Wind Tunnel

Figure 8. - Photographs of model

(b) Closeup of installation, $\theta = 36$ degrees

Figure 8. - Concluded



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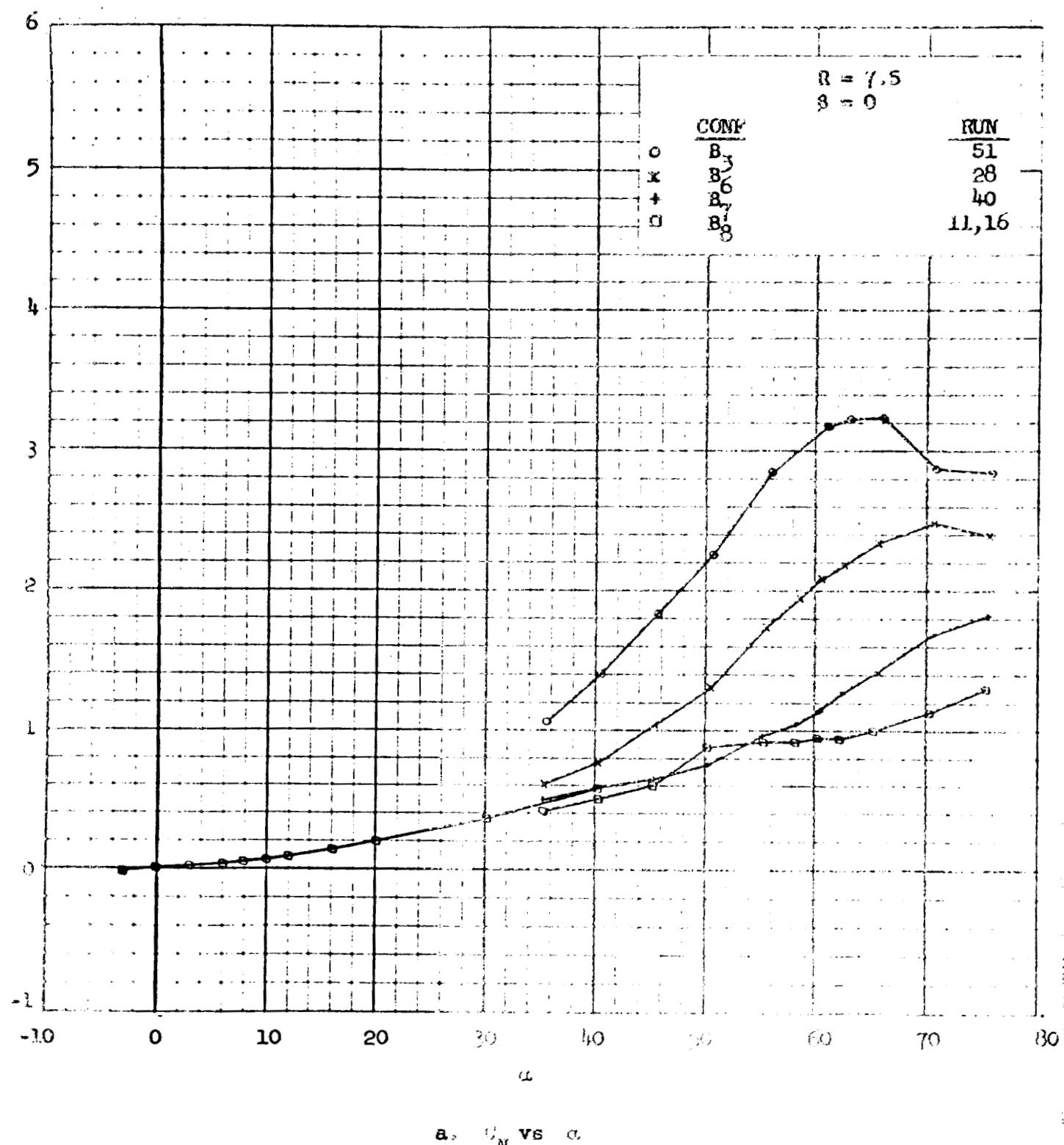
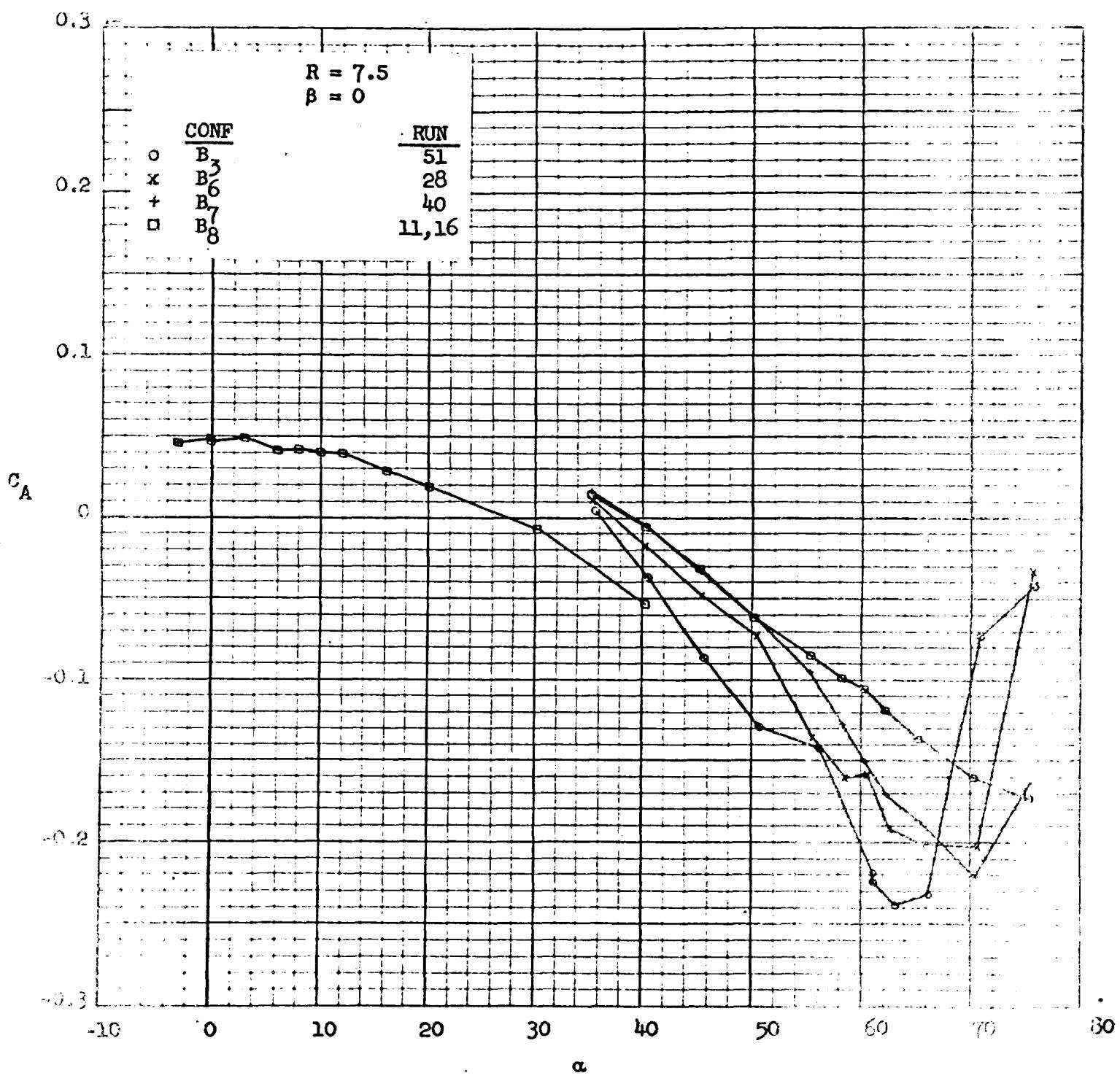


Figure 9. - Effect of angle of attack on longitudinal characteristics with various body corner radii for body only configuration, $R = 7.5$.

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PRELIMINARY DATA



b. C_A vs α

Figure 9. - continued

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PRELIMINARY DATA

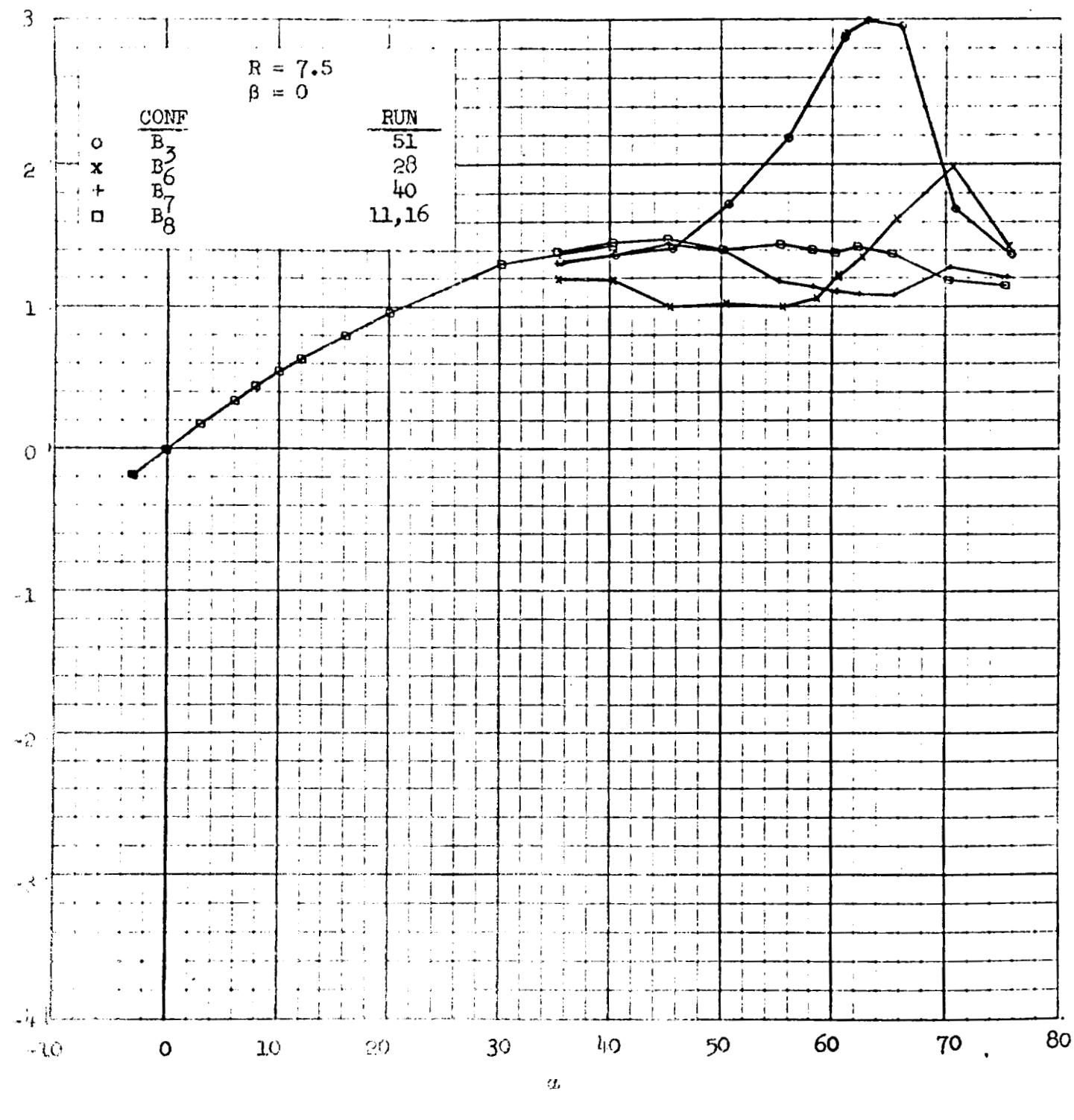


Figure 9. - continued

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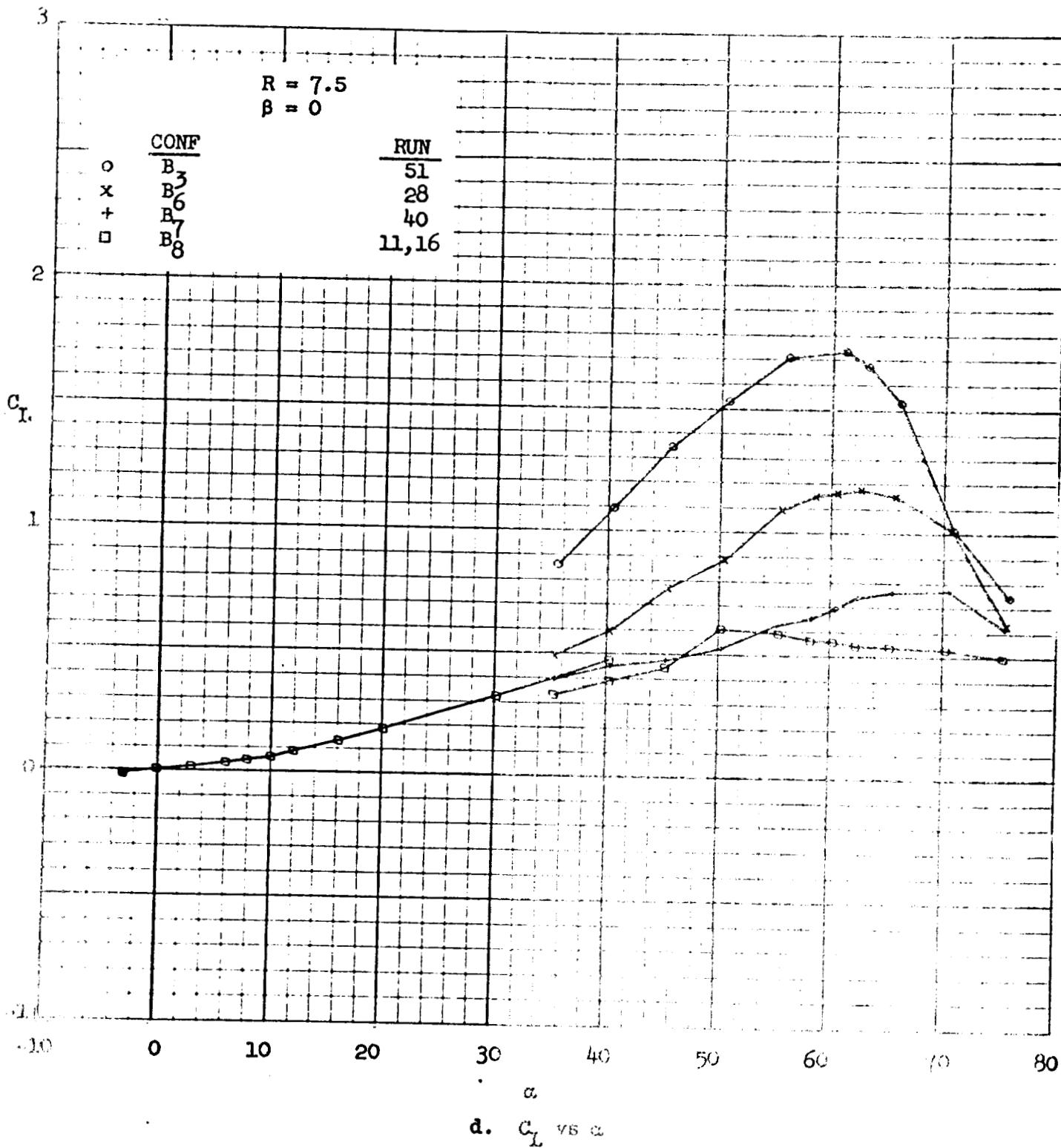
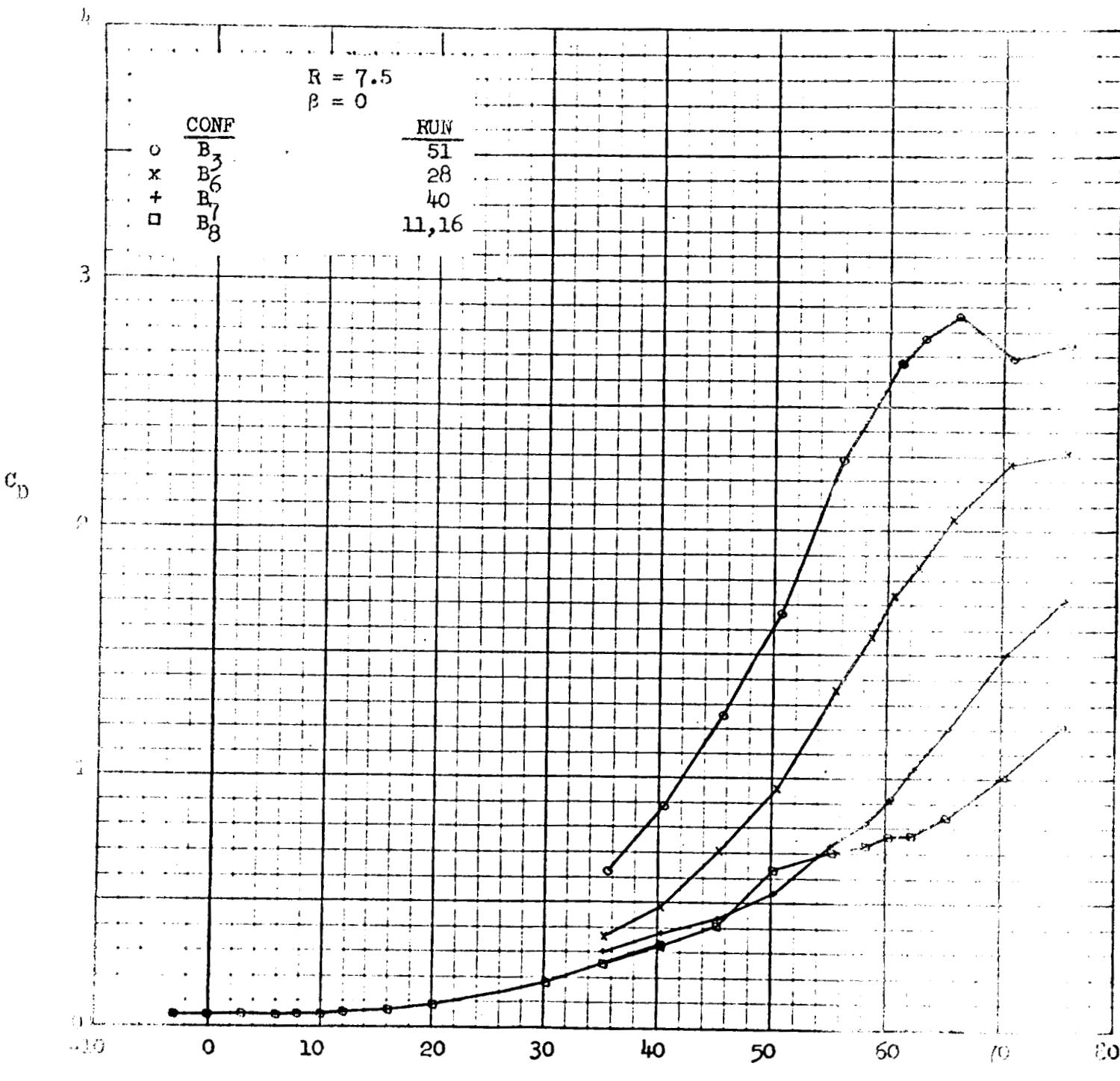


Figure 9 - Continued

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e. C_D vs α

Figure 9. - continued

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PRELIMINARY DATA

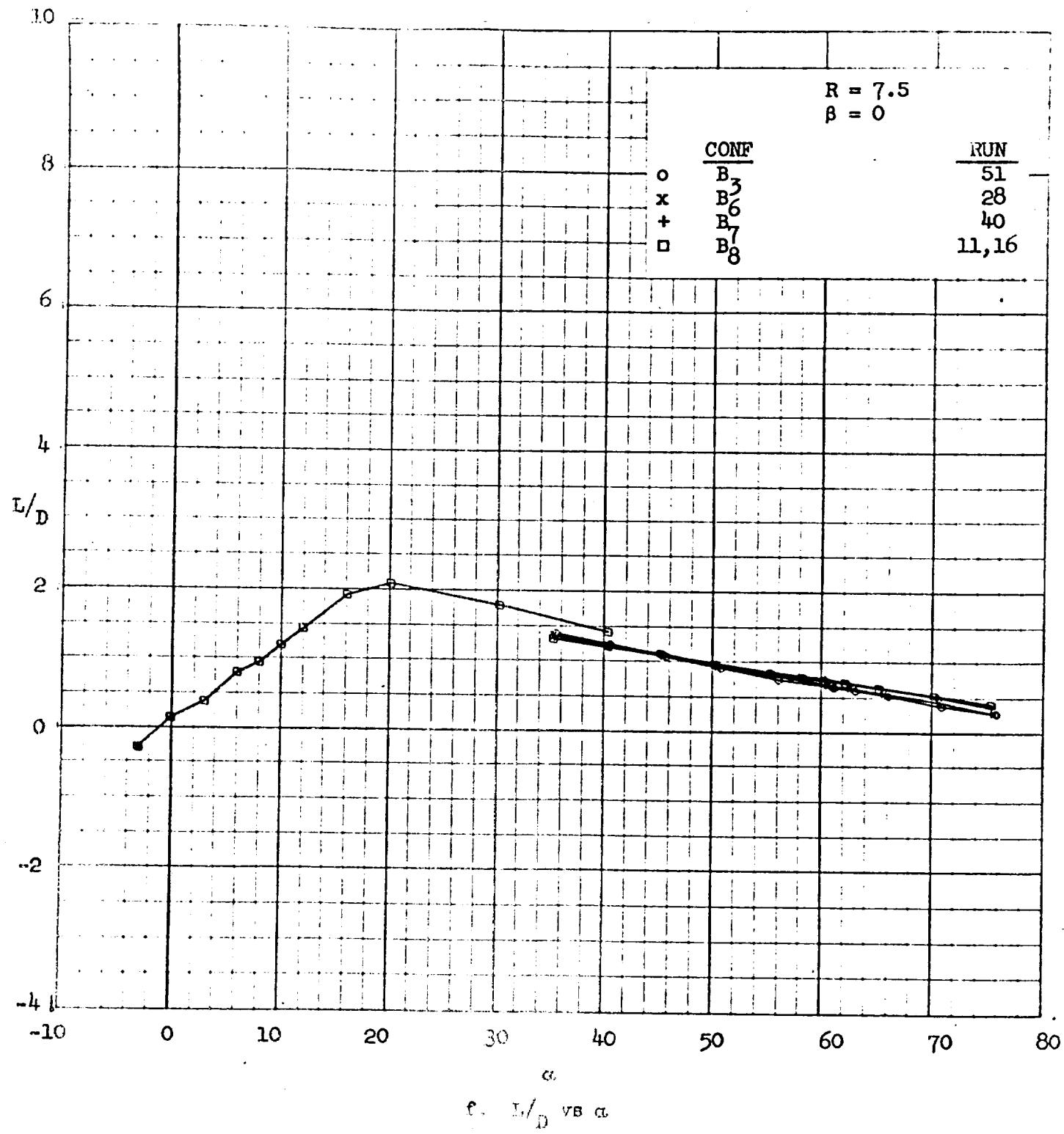


Figure 9 . - Concluded

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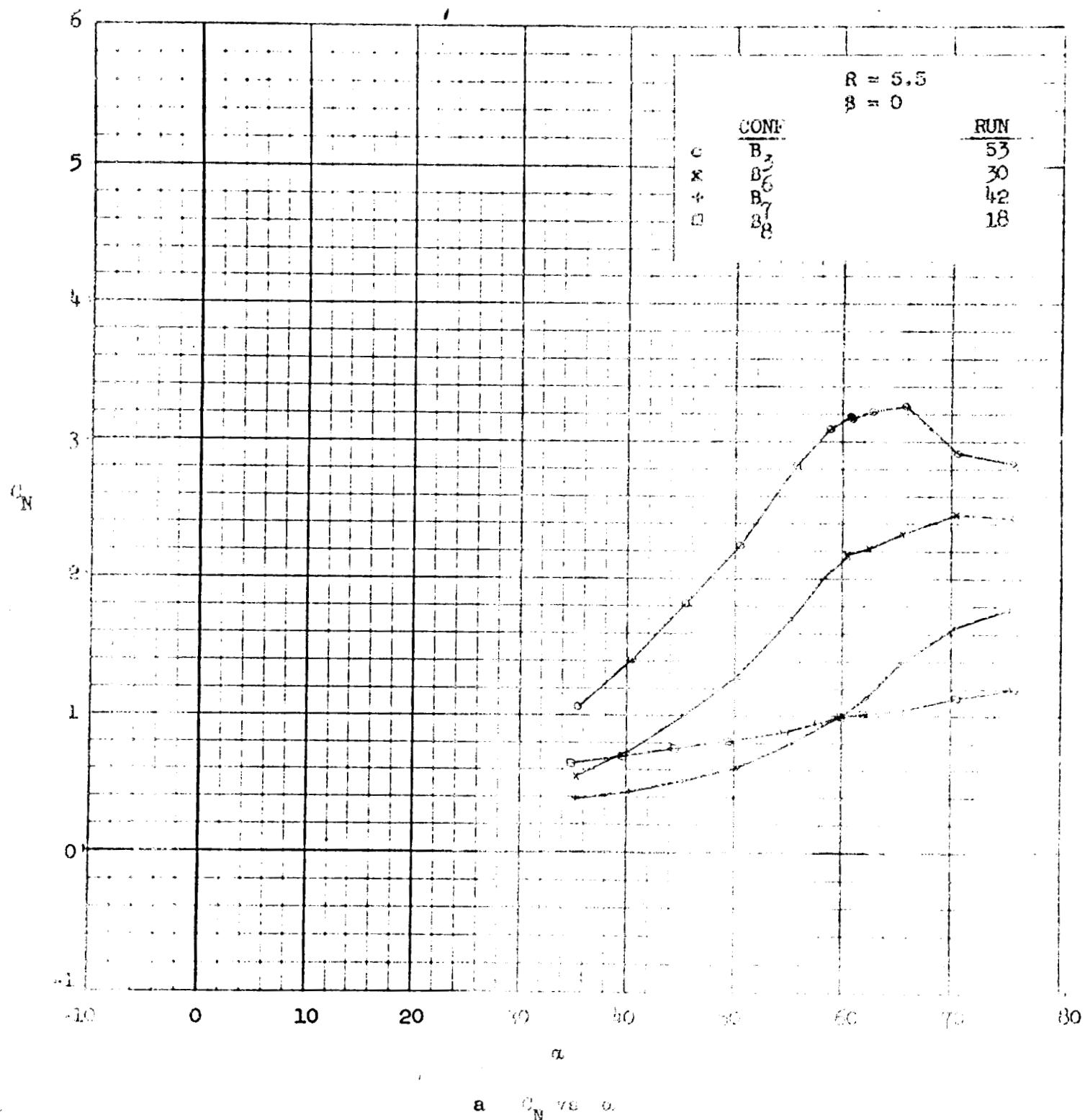
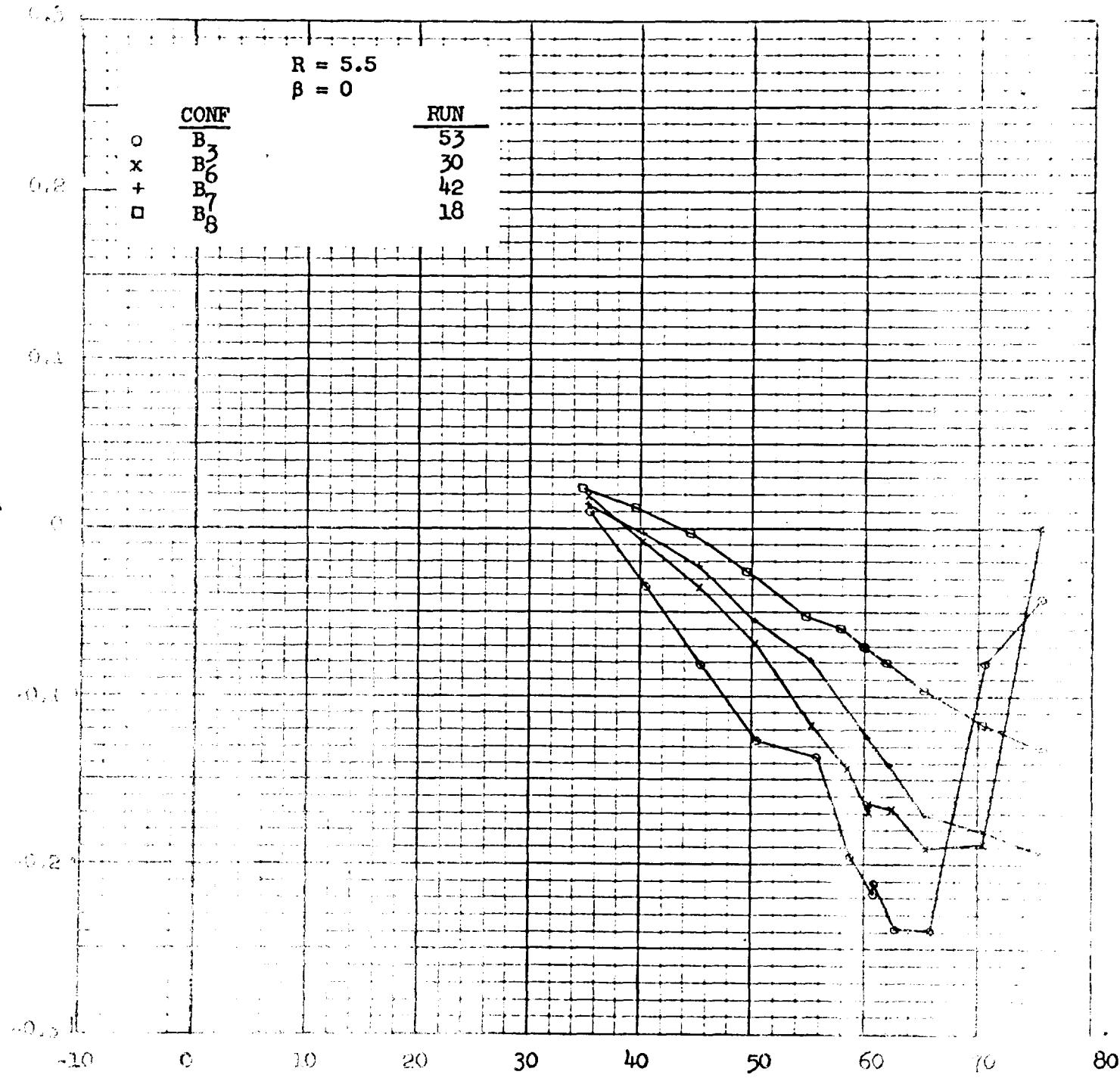


Figure 10. - Effect of angle of attack on lift coefficient variation with various body corner radii for body configuration B-5.

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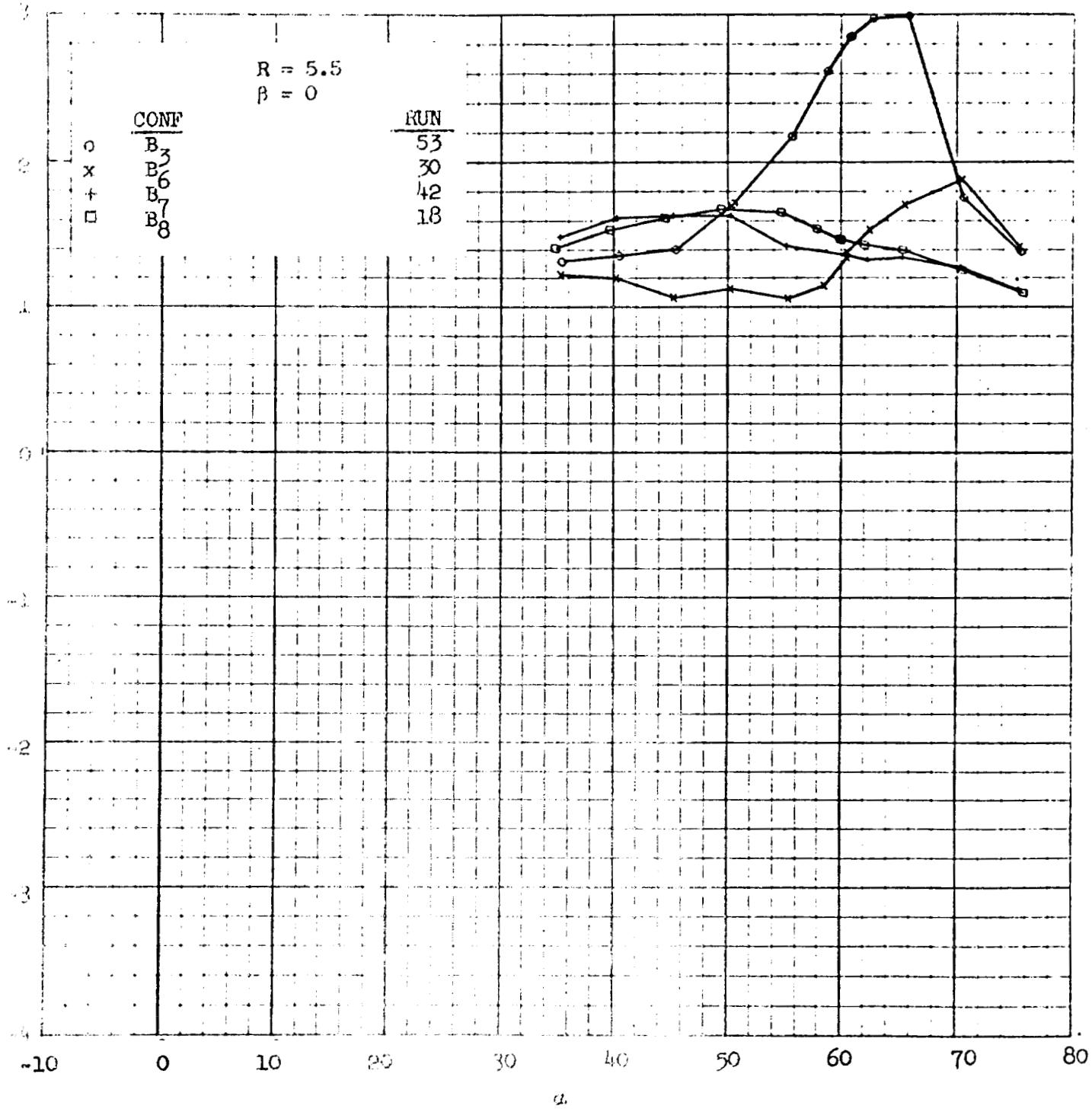


b. C_A vs α

Figure 15. C_A vs α .

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PRELIMINARY DATA



C_m vs α

Figure 10. - continued

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PRELIMINARY DATA

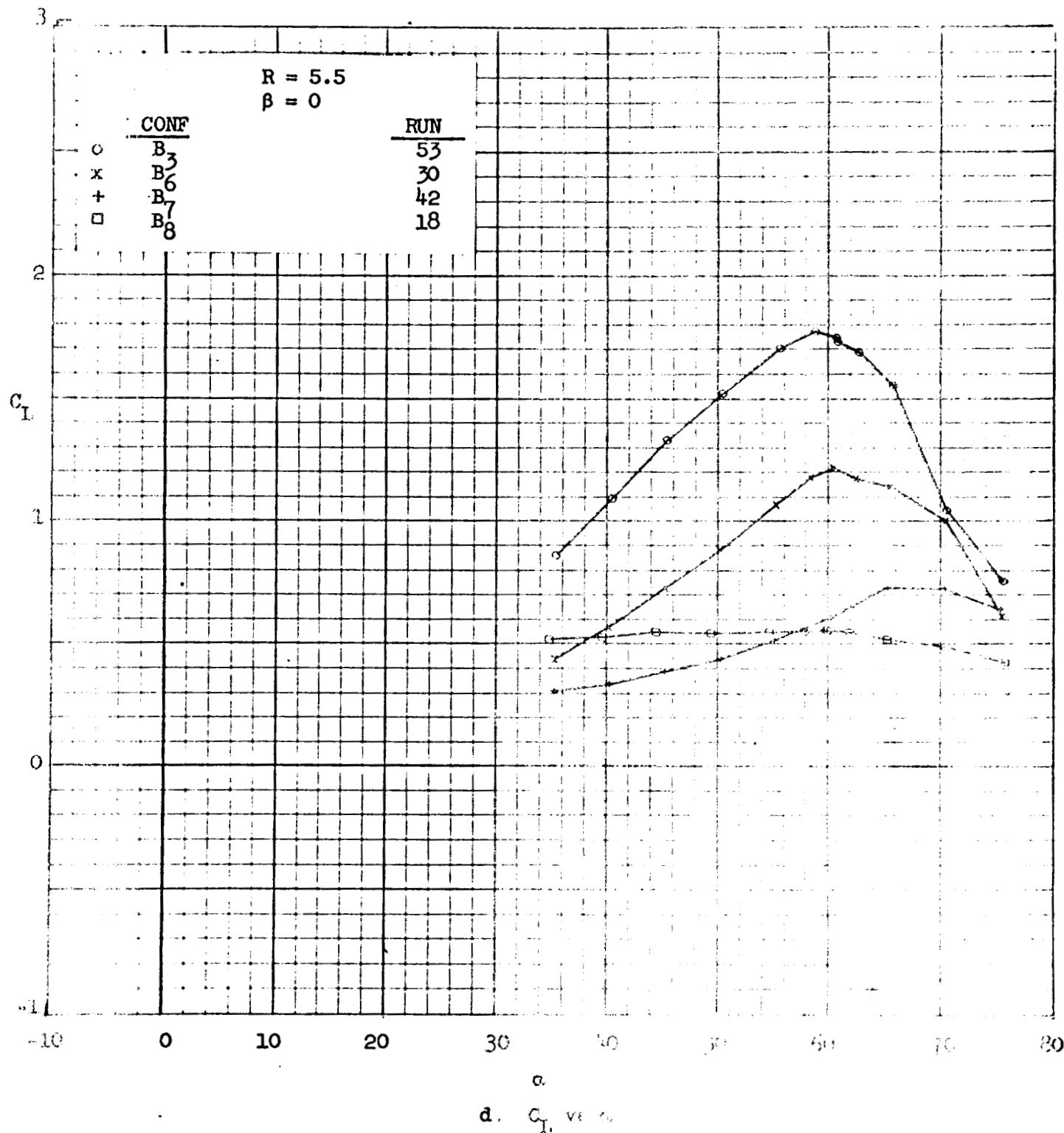


Figure 10. - Continued

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PRELIMINARY DATA

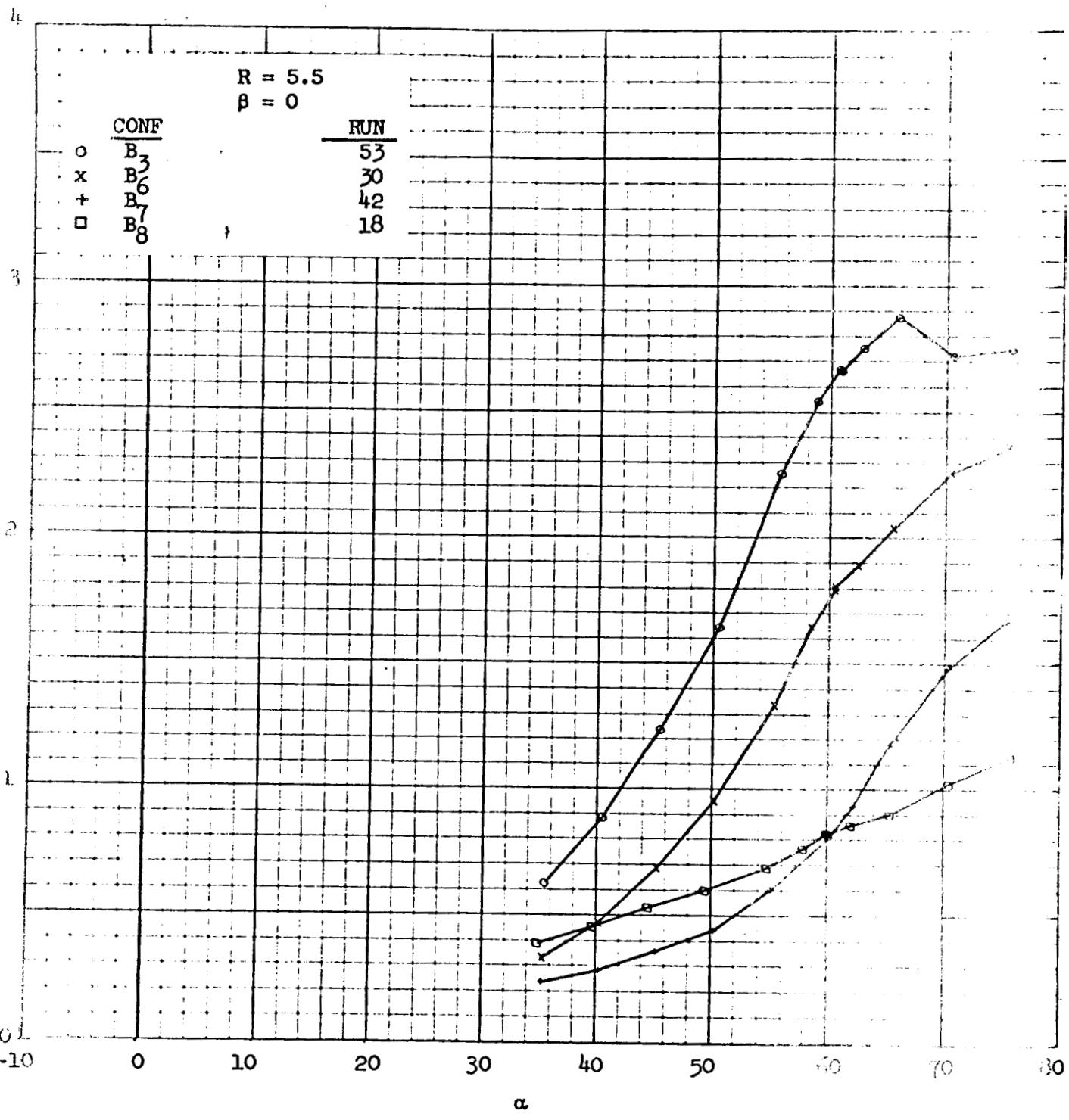


Figure 10. - continued

National Aeronautics and Space Administration
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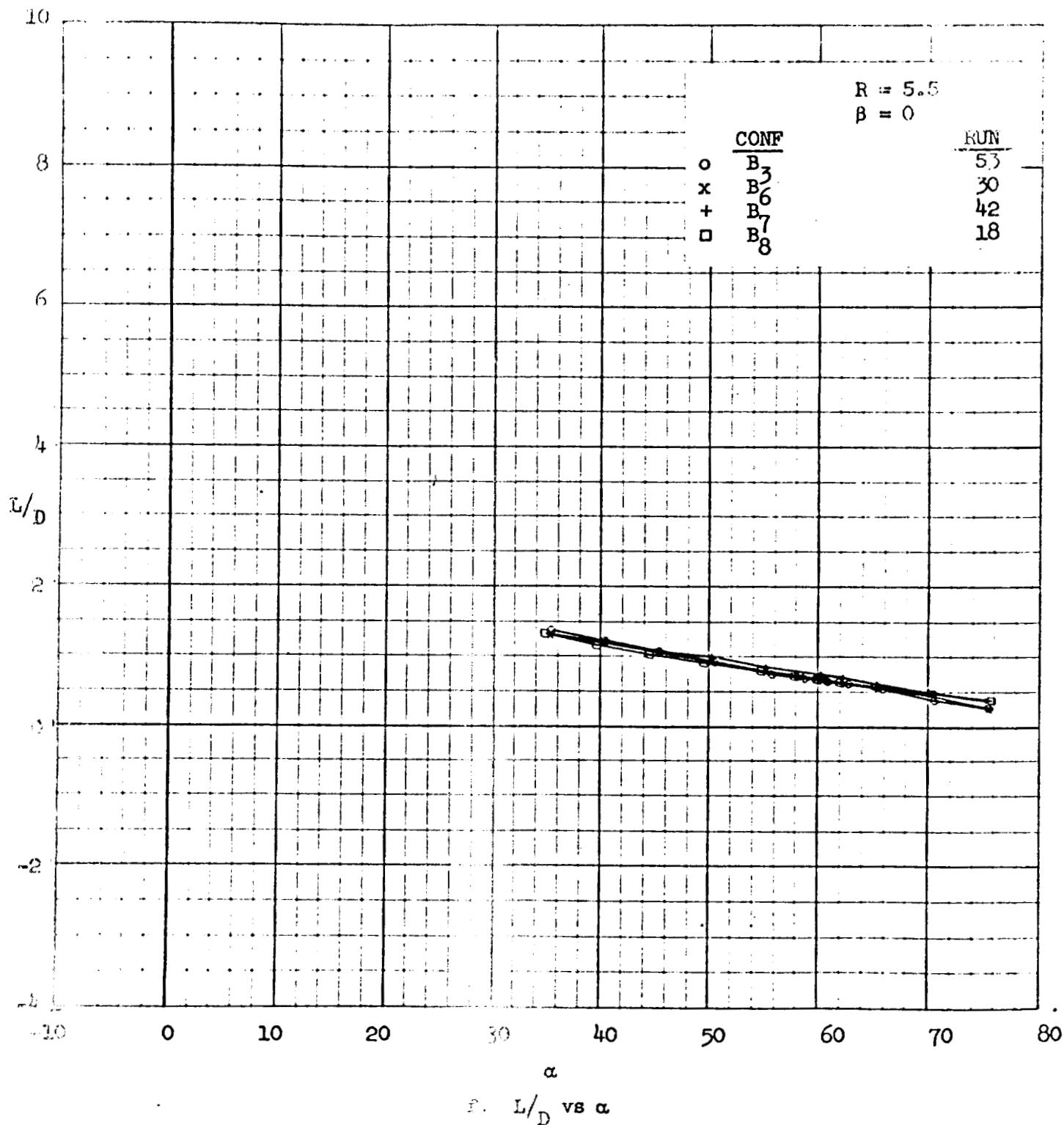


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National Aeronautics and Space Administration
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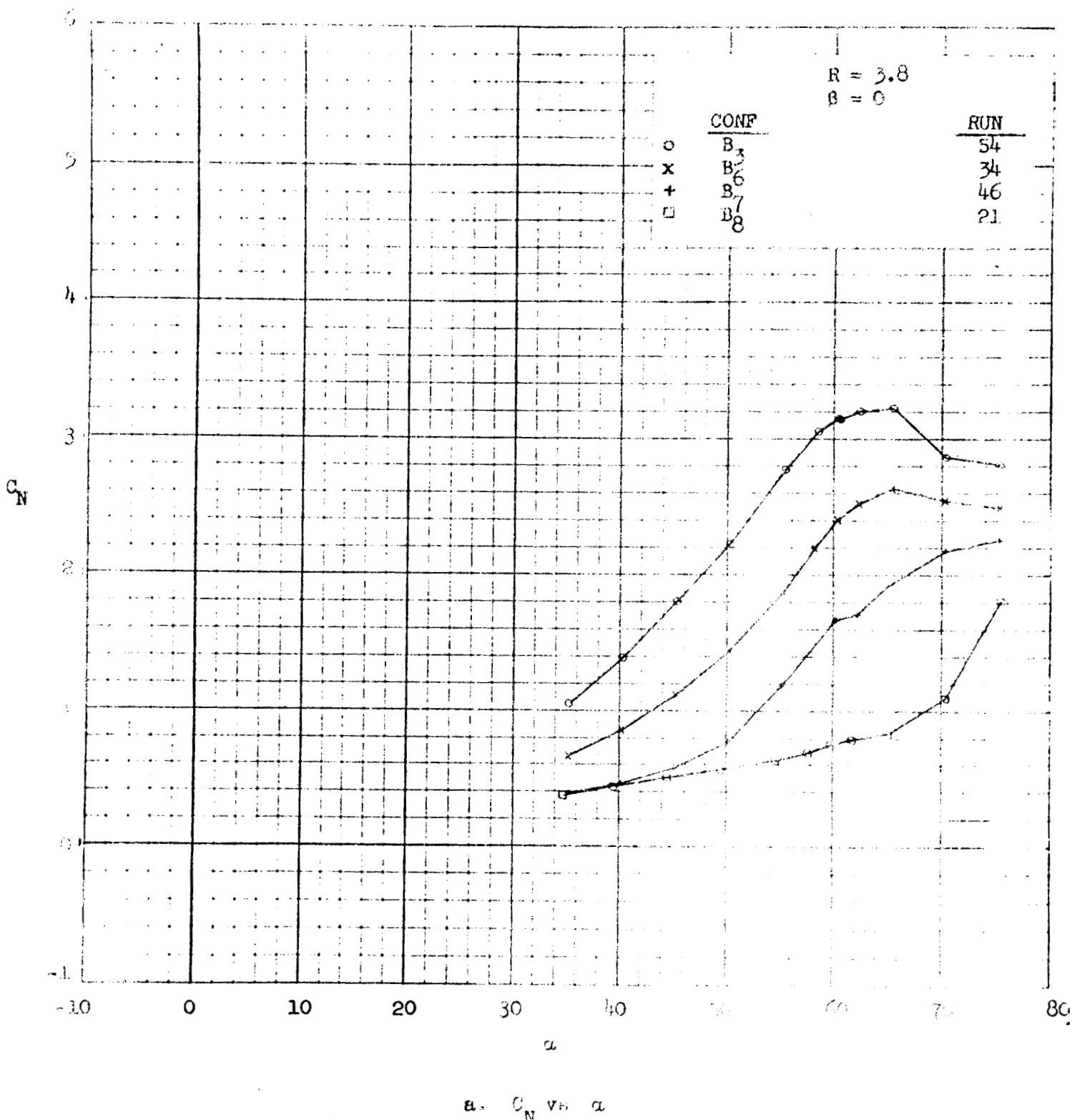
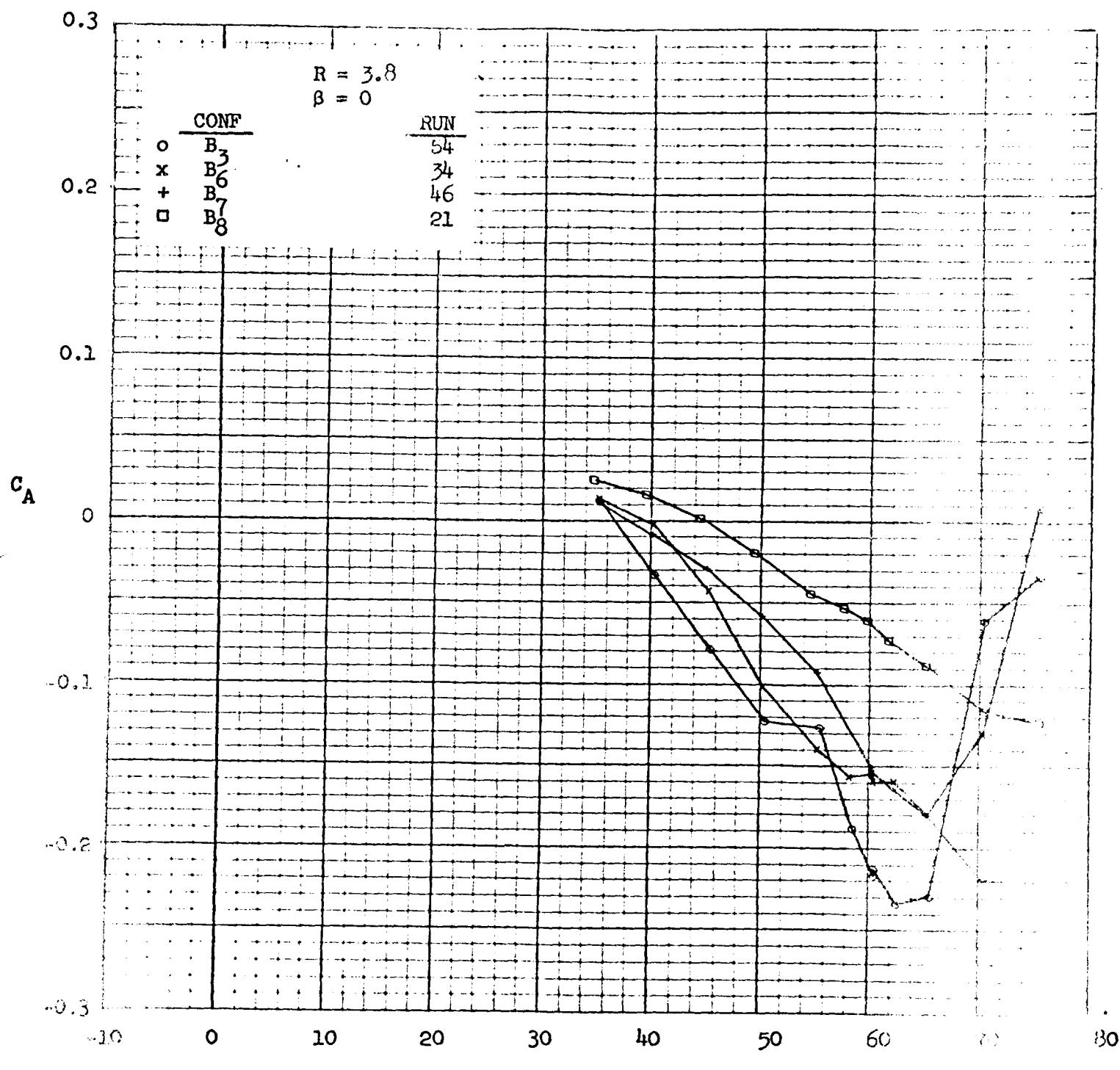


Figure 11. - Effect of angle of attack on longitudinal coefficients of various body corner radii for body and configuration, $R = 3.8$.

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



b. C_A vs α

Figure 11. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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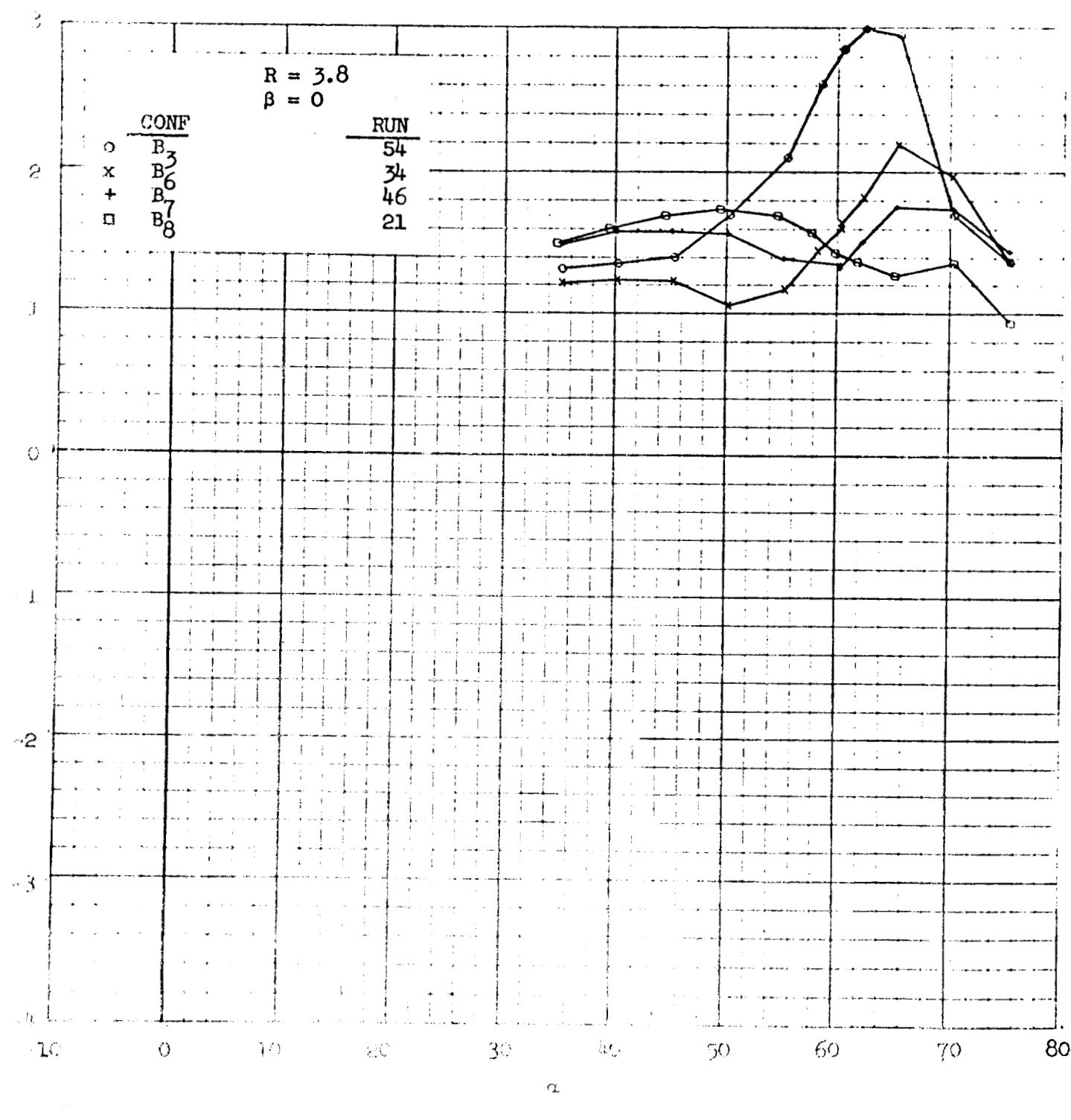


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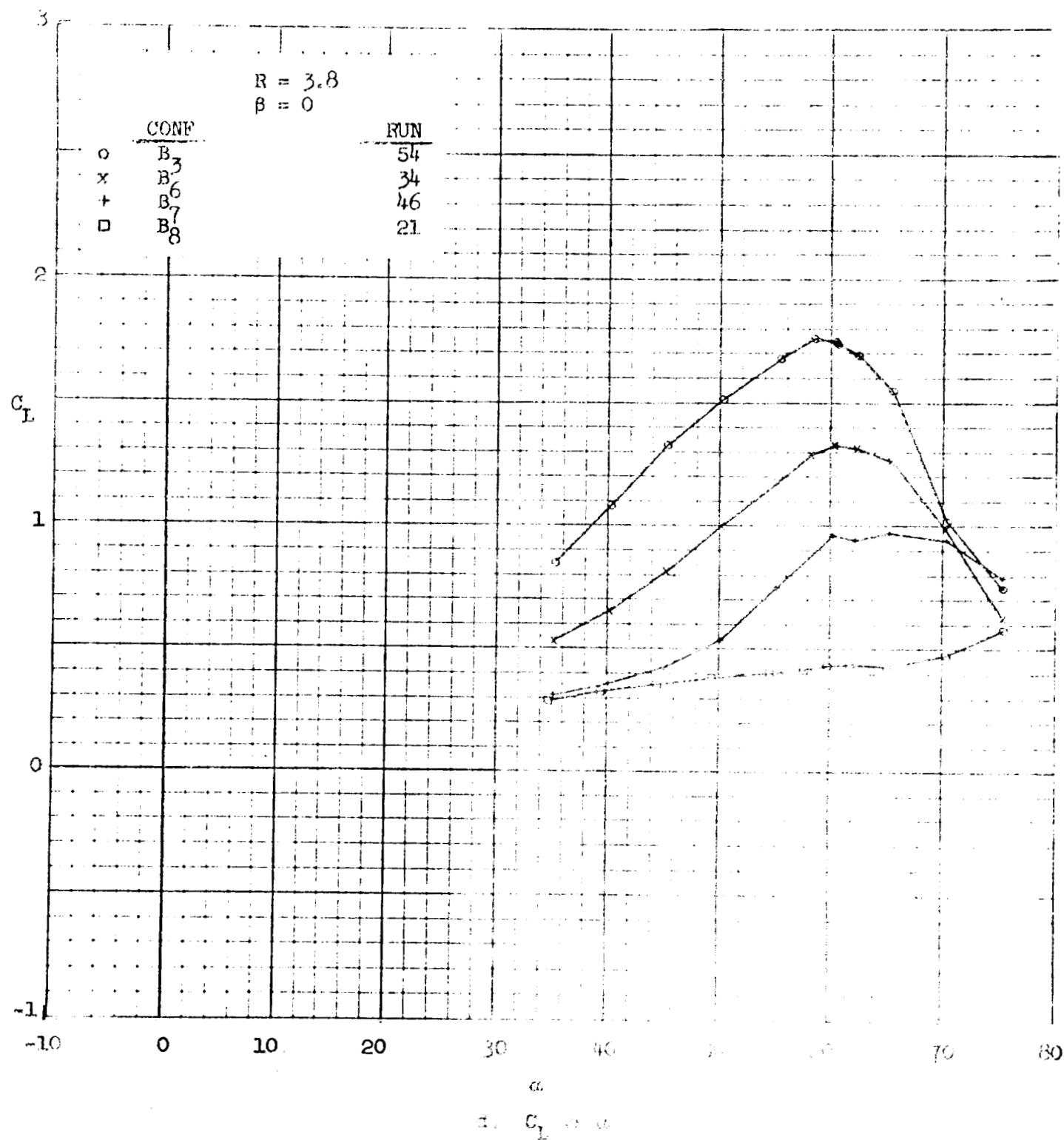
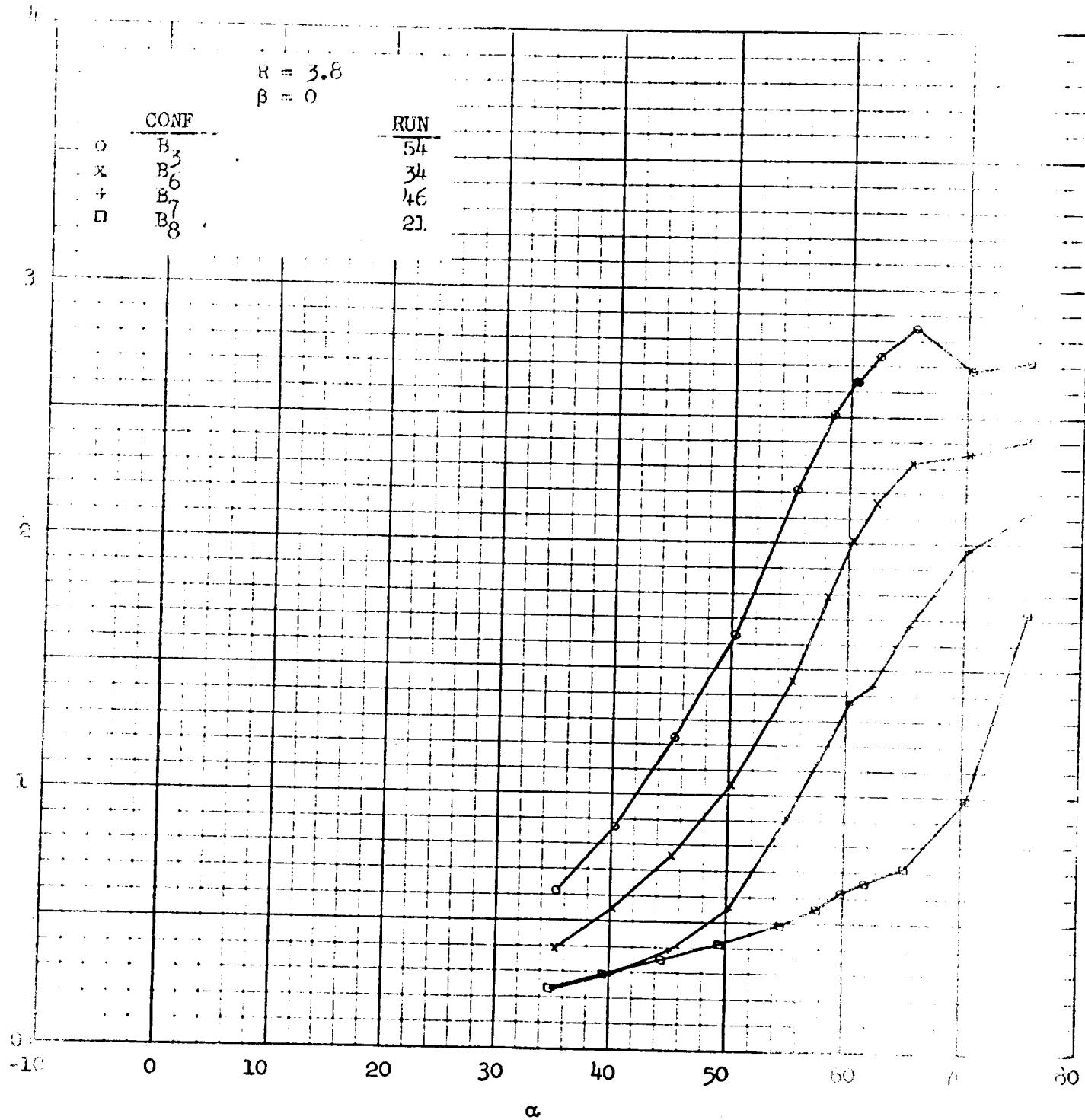


Figure 11. - Continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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e. C_D vs α

Figure 11. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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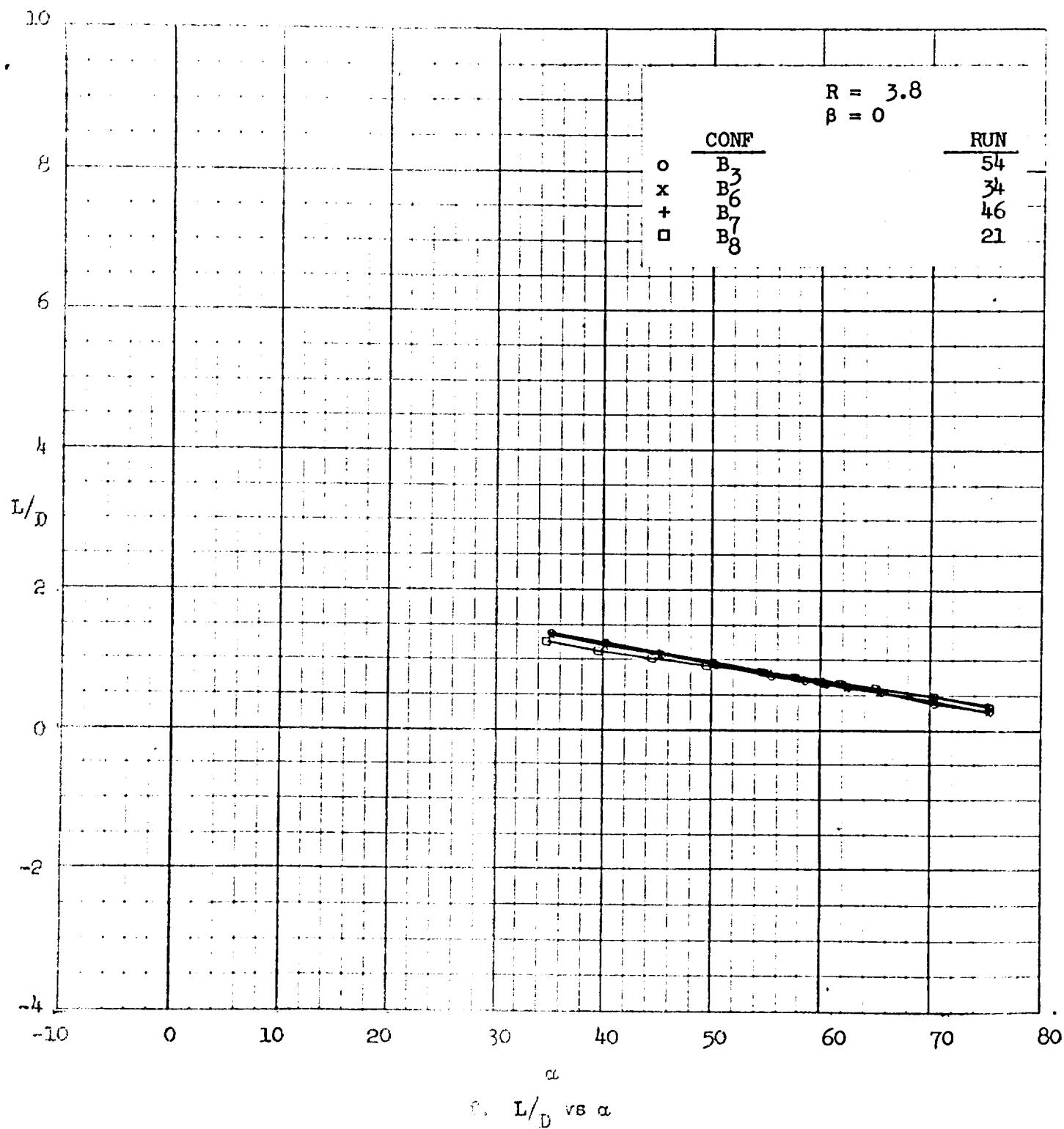
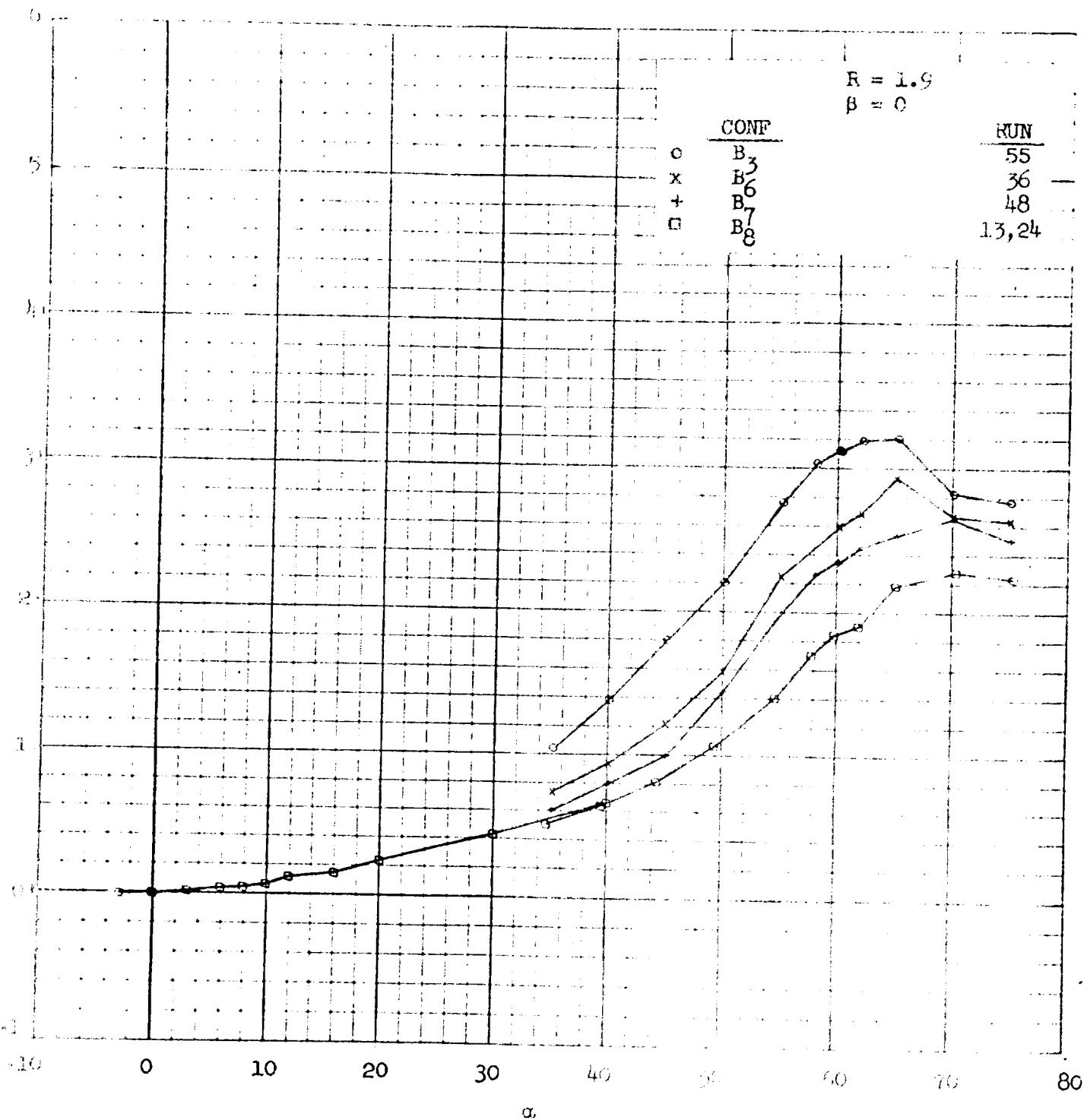


Figure 11 -- Concluded

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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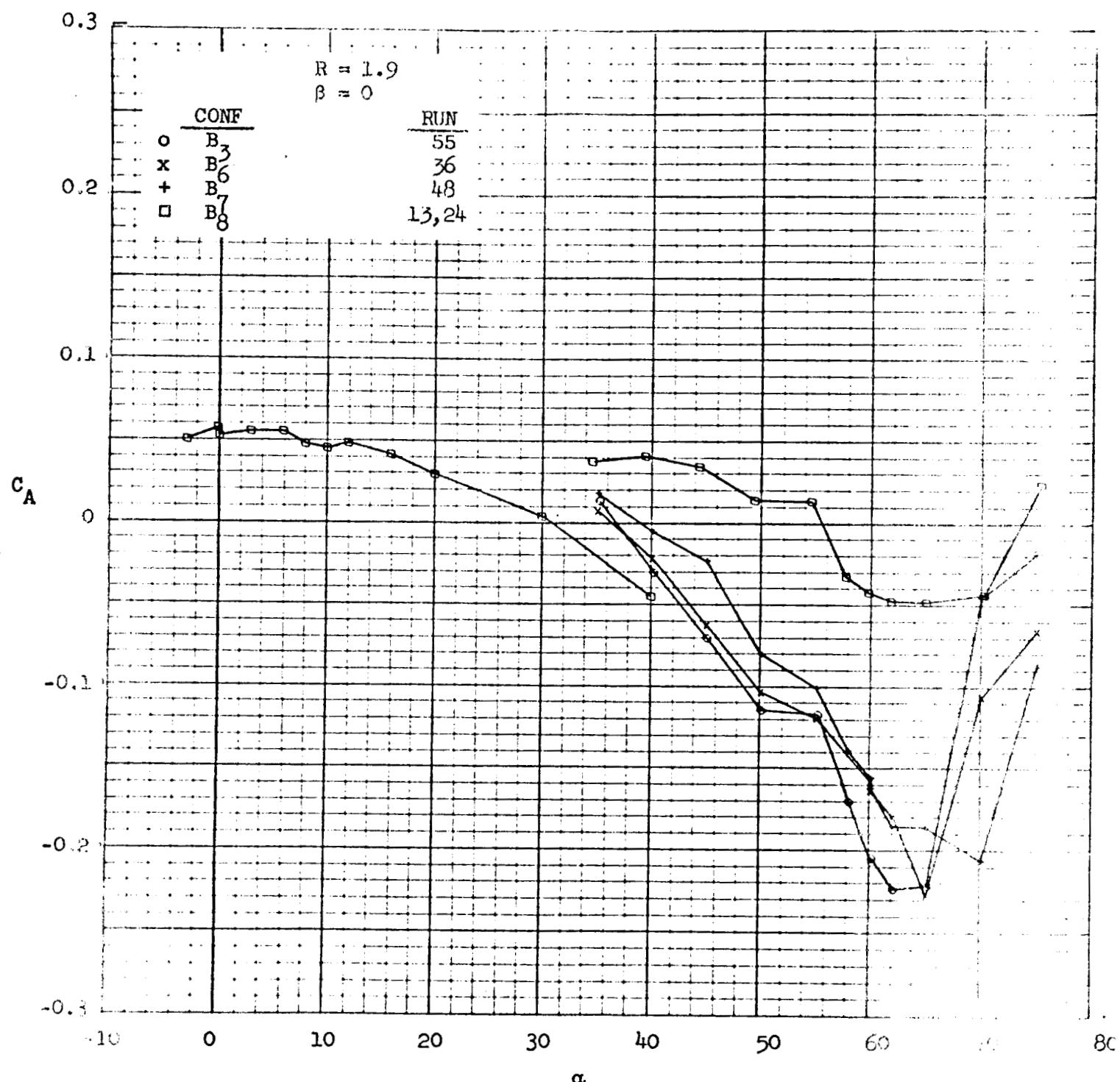


a. C_N vs α

Figure 12. - Effect of angle of attack on lift coefficient for various configurations with various body corner radii for $R = 1.9$, $\beta = 0$.

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Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



b. C_A vs α

Figure 12. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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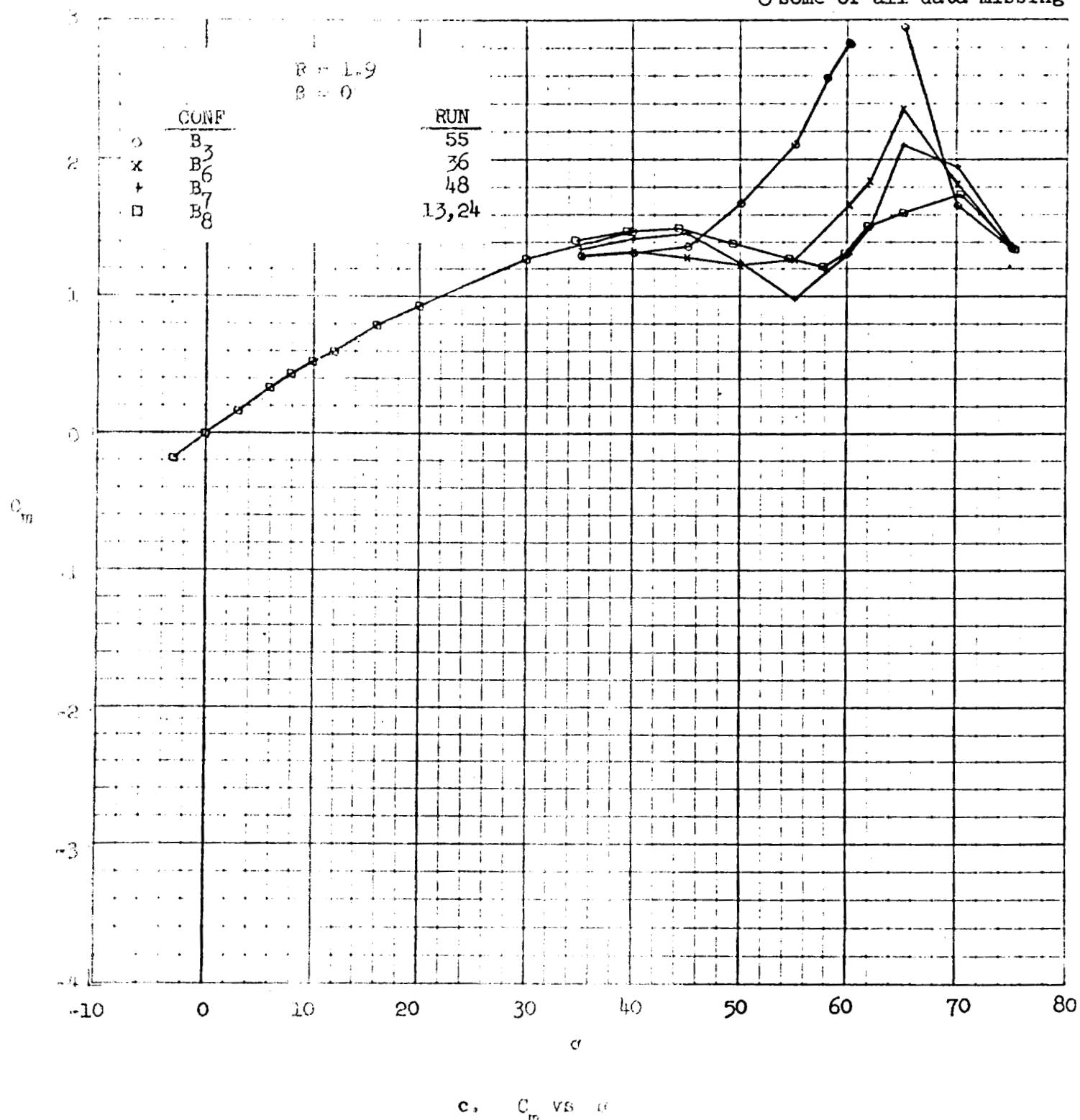


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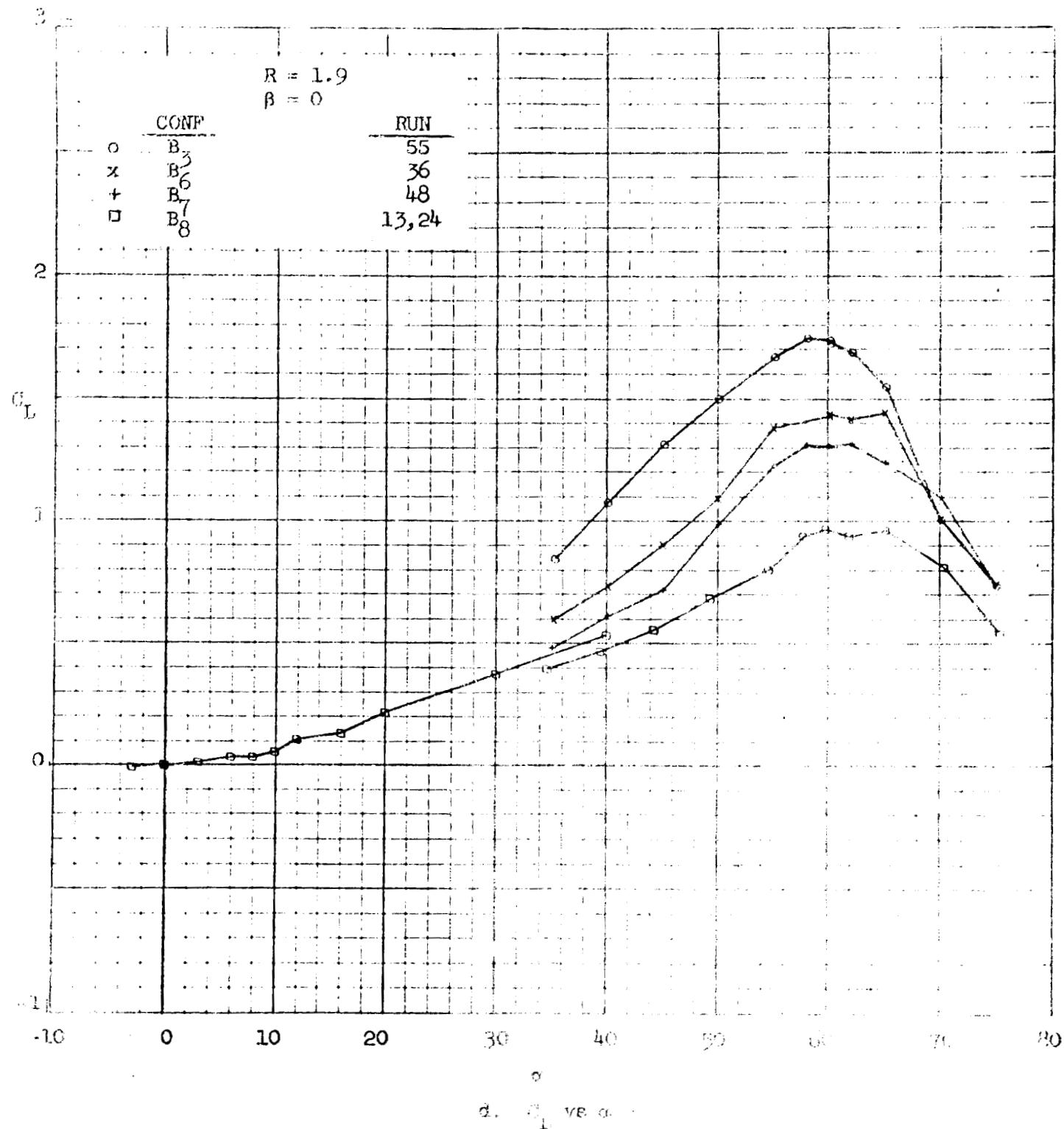
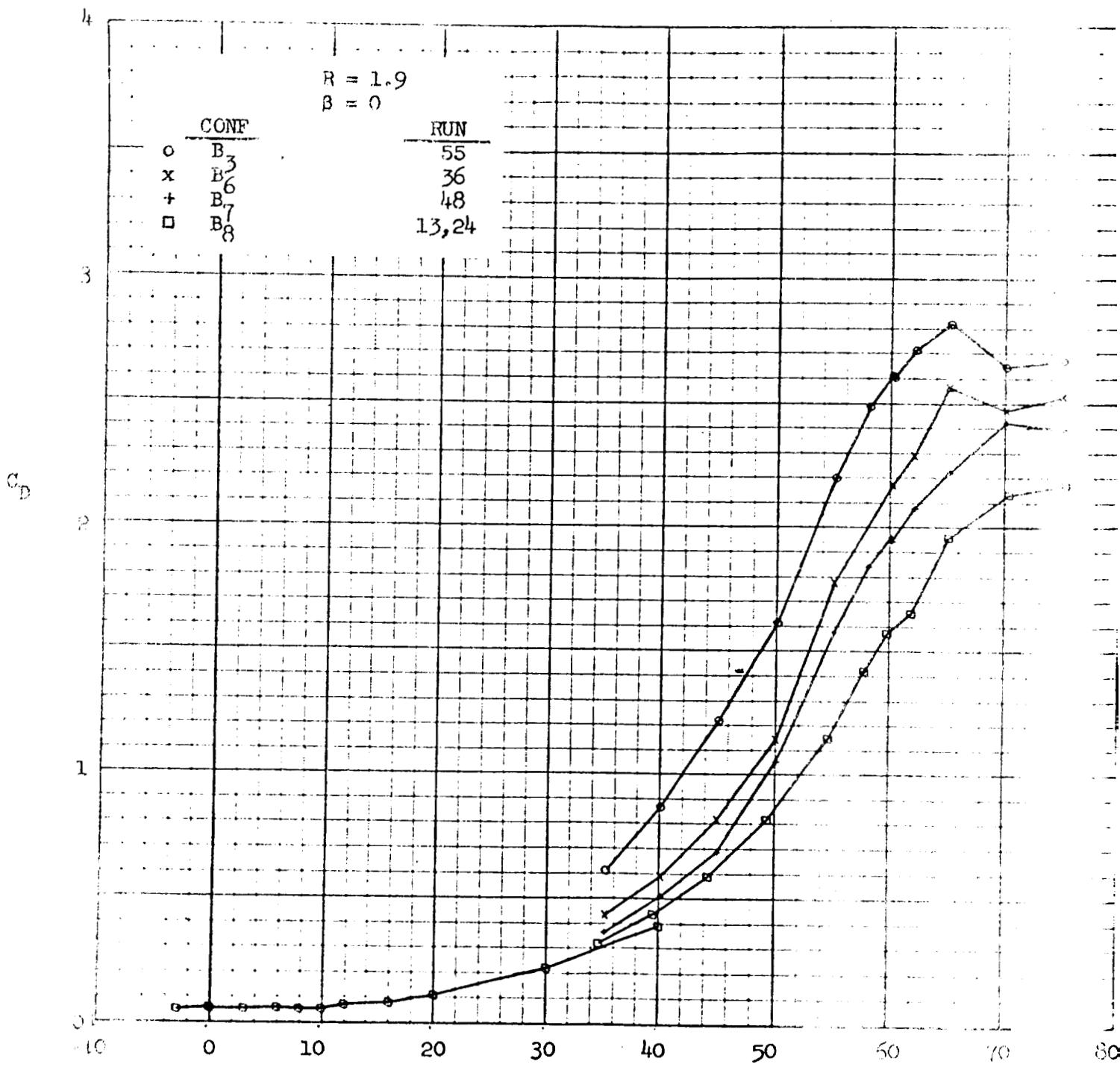


Figure 12. - Continued

National Aeronautics and Space Administration
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e. C_D vs α

Figure 12. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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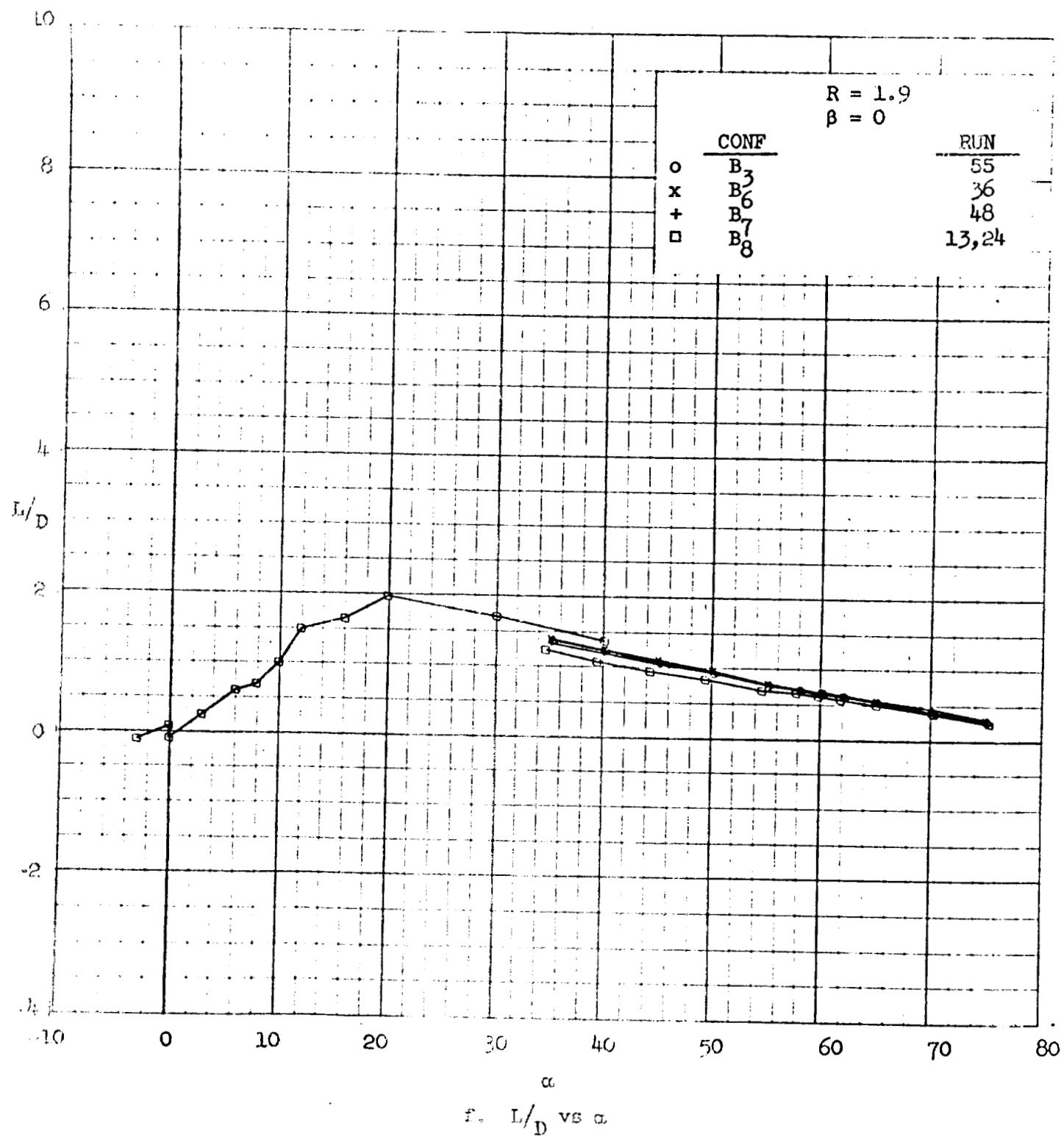
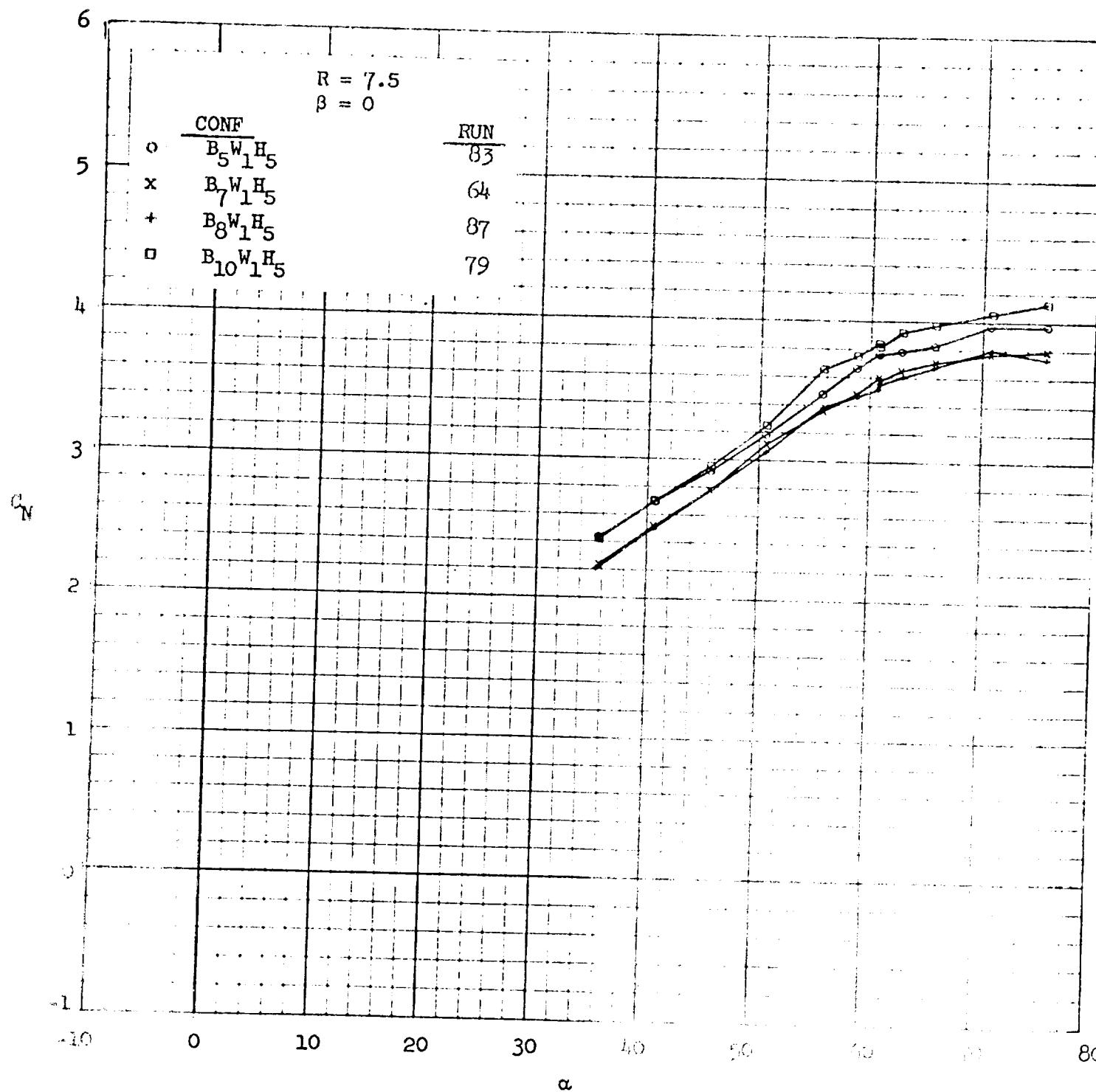


Figure 12. - Concluded

National Aeronautics and Space Administration
Ames Research Center, MOFFETT FIELD, CALIF.

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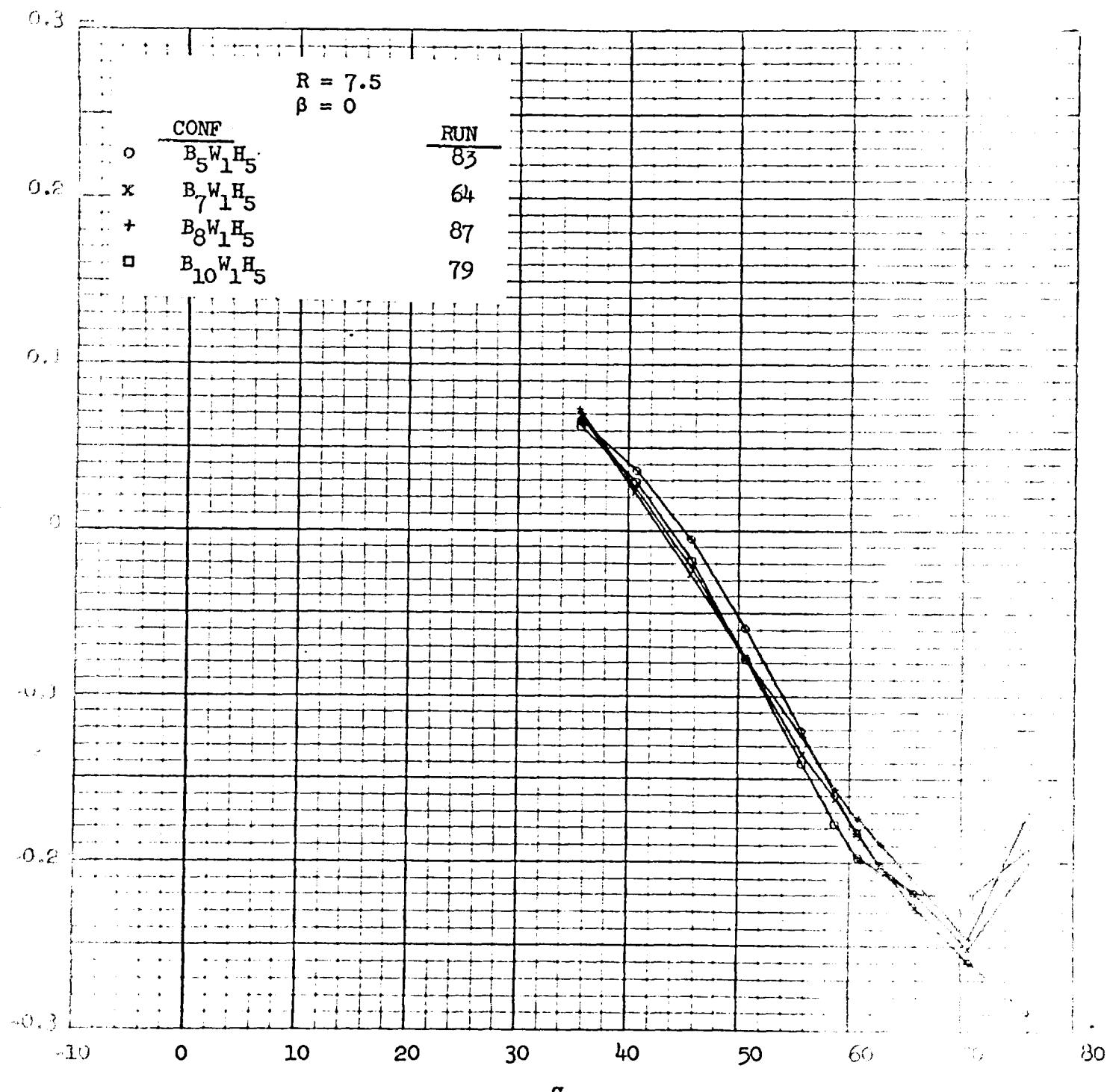
a. C_N vs α

Figure 13. - Effect of angle of attack on low-lift-line characteristics for various body corner radii for configuration B_5W1H5 at $R = 7.5$.

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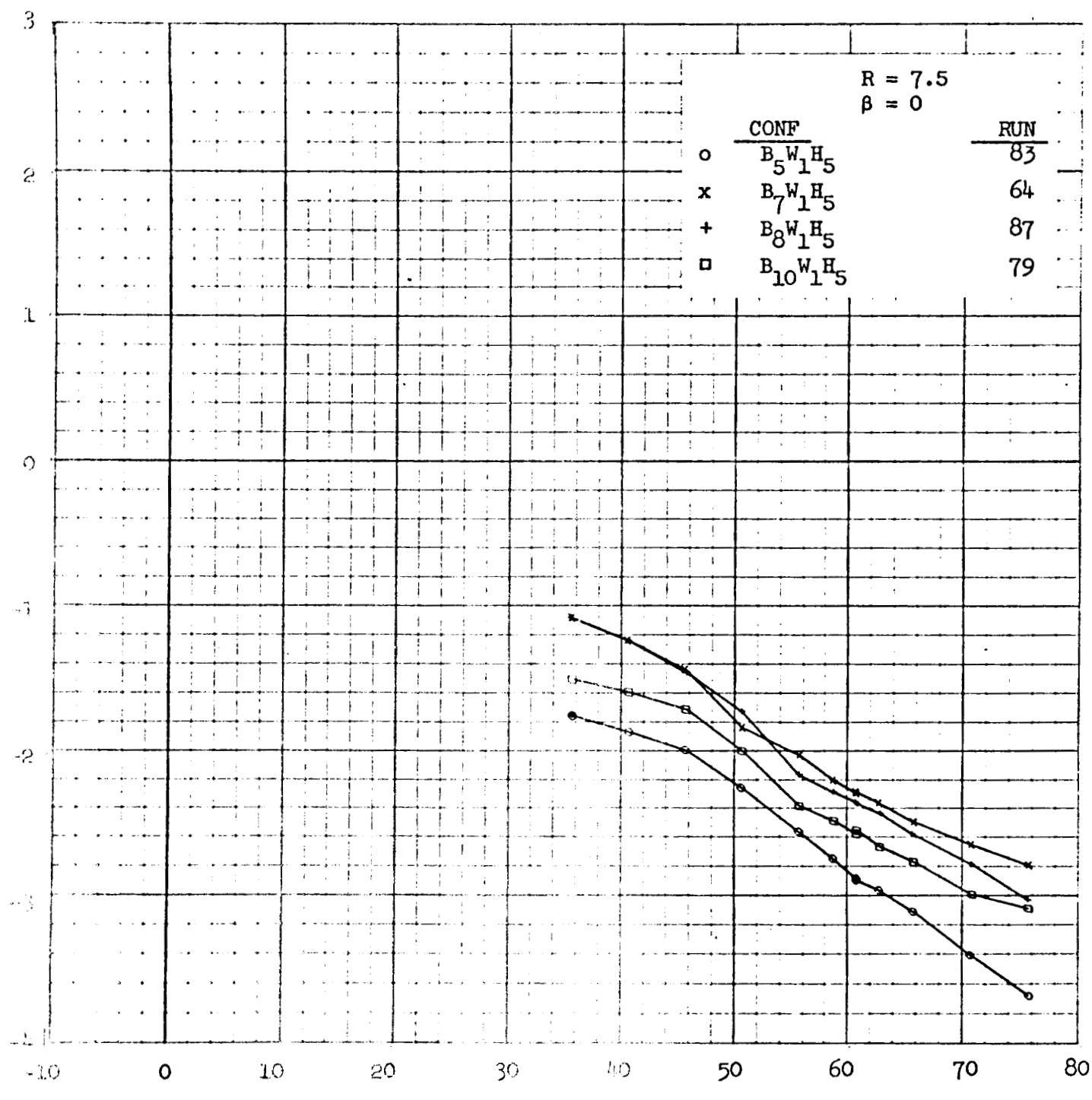


b. C_A vs α

Figure 15. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



c. C_m vs α

Figure 13. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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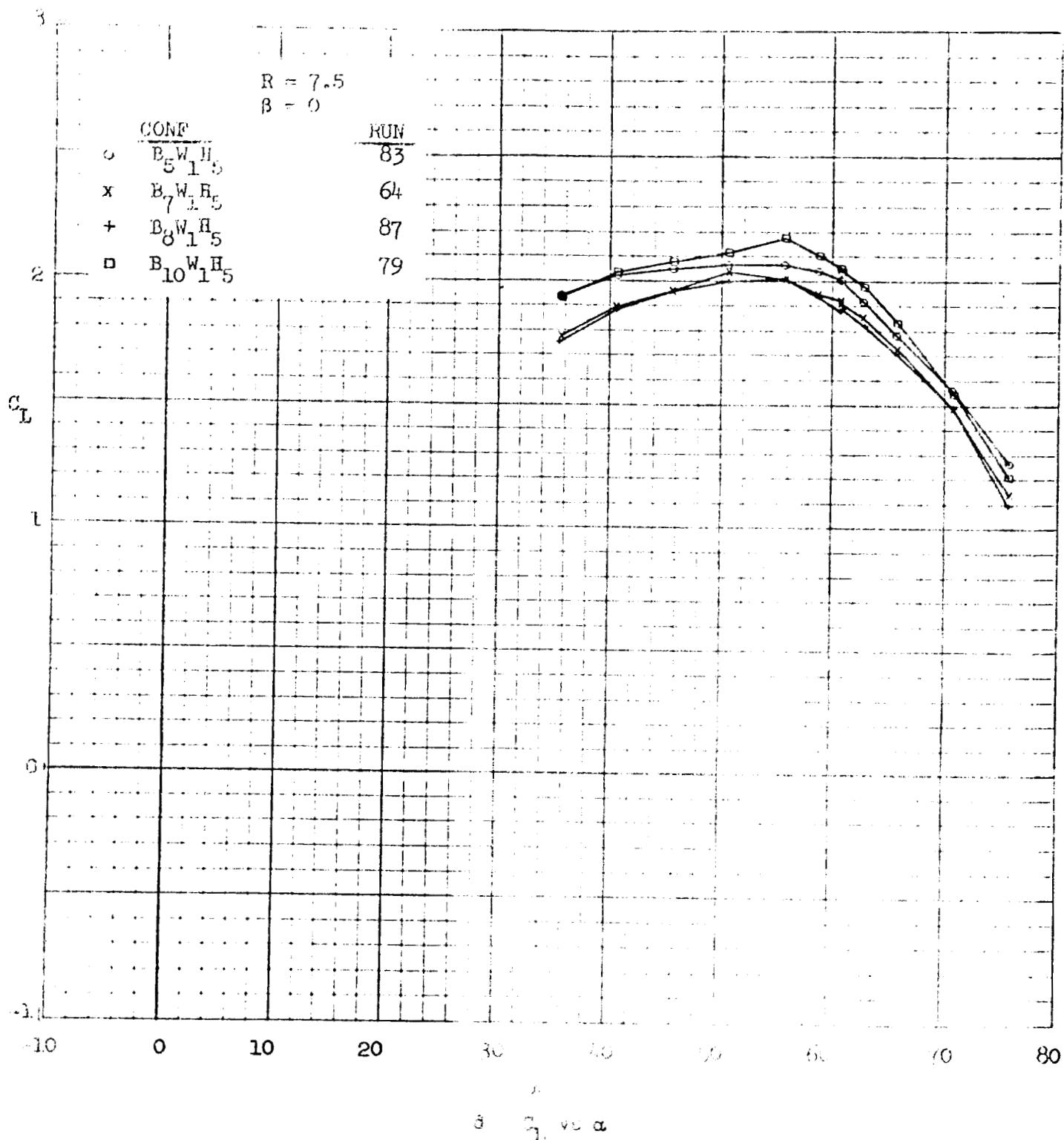


Figure 13. - Continued

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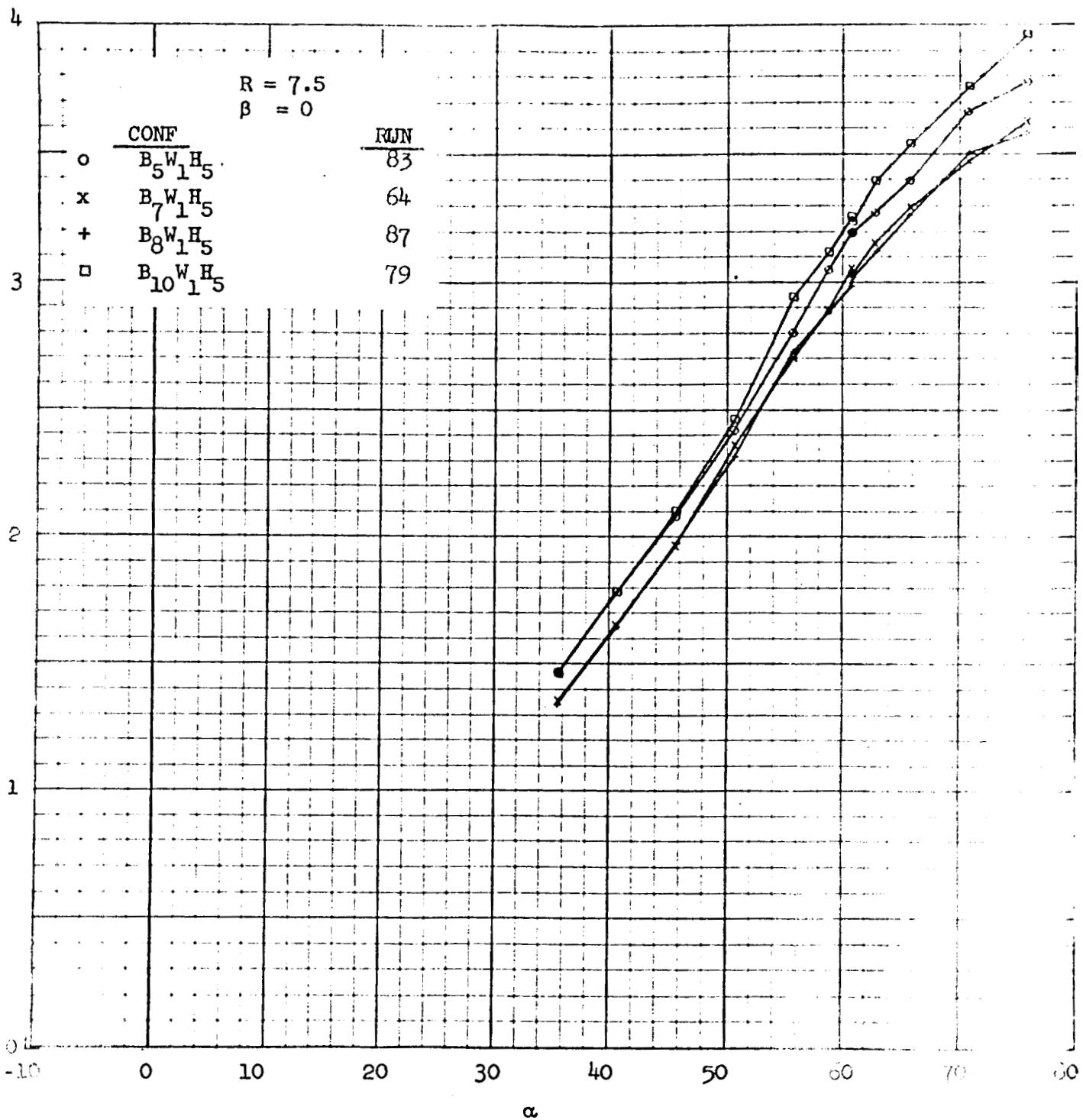


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National Aeronautics and Space Administration
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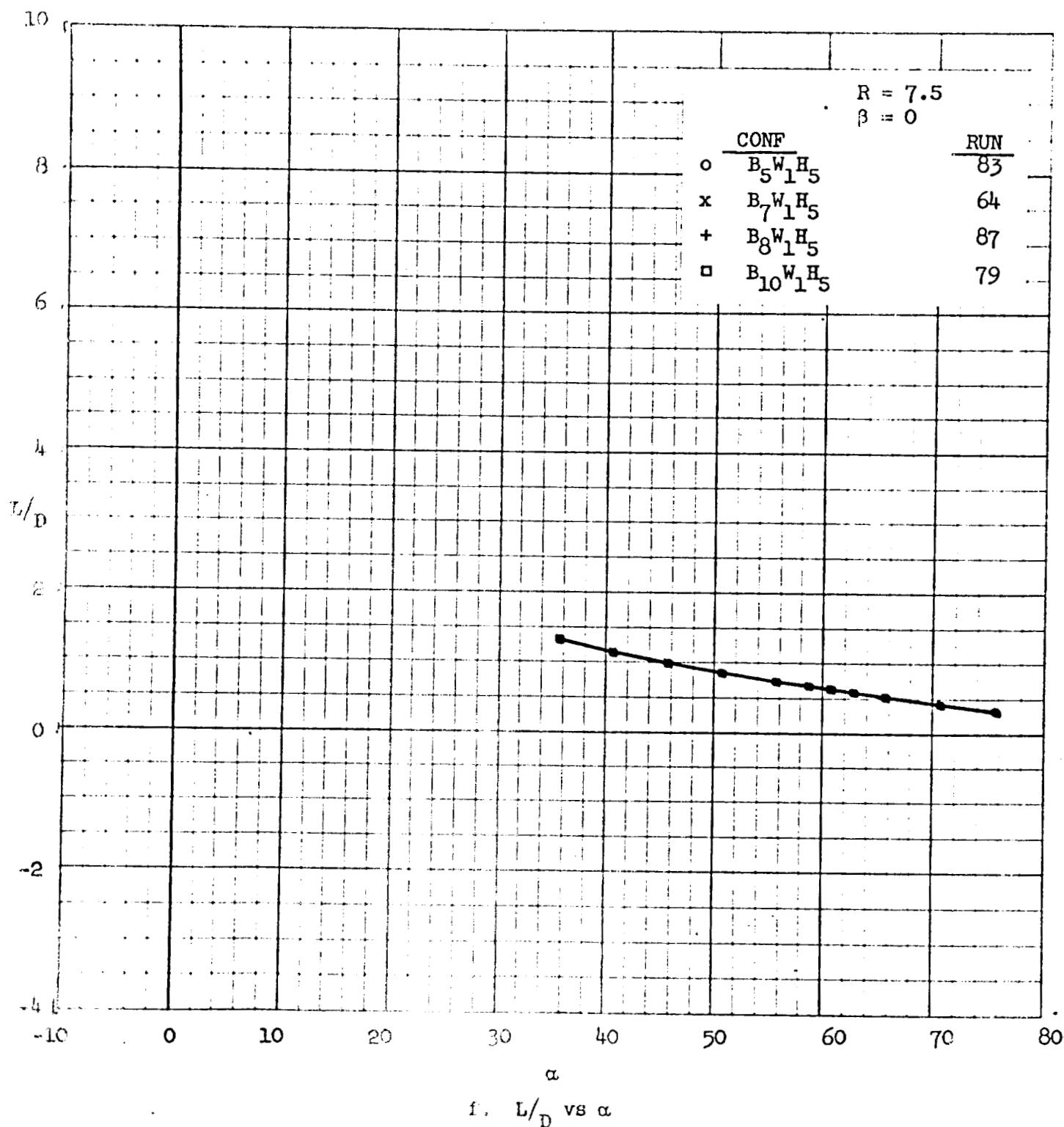
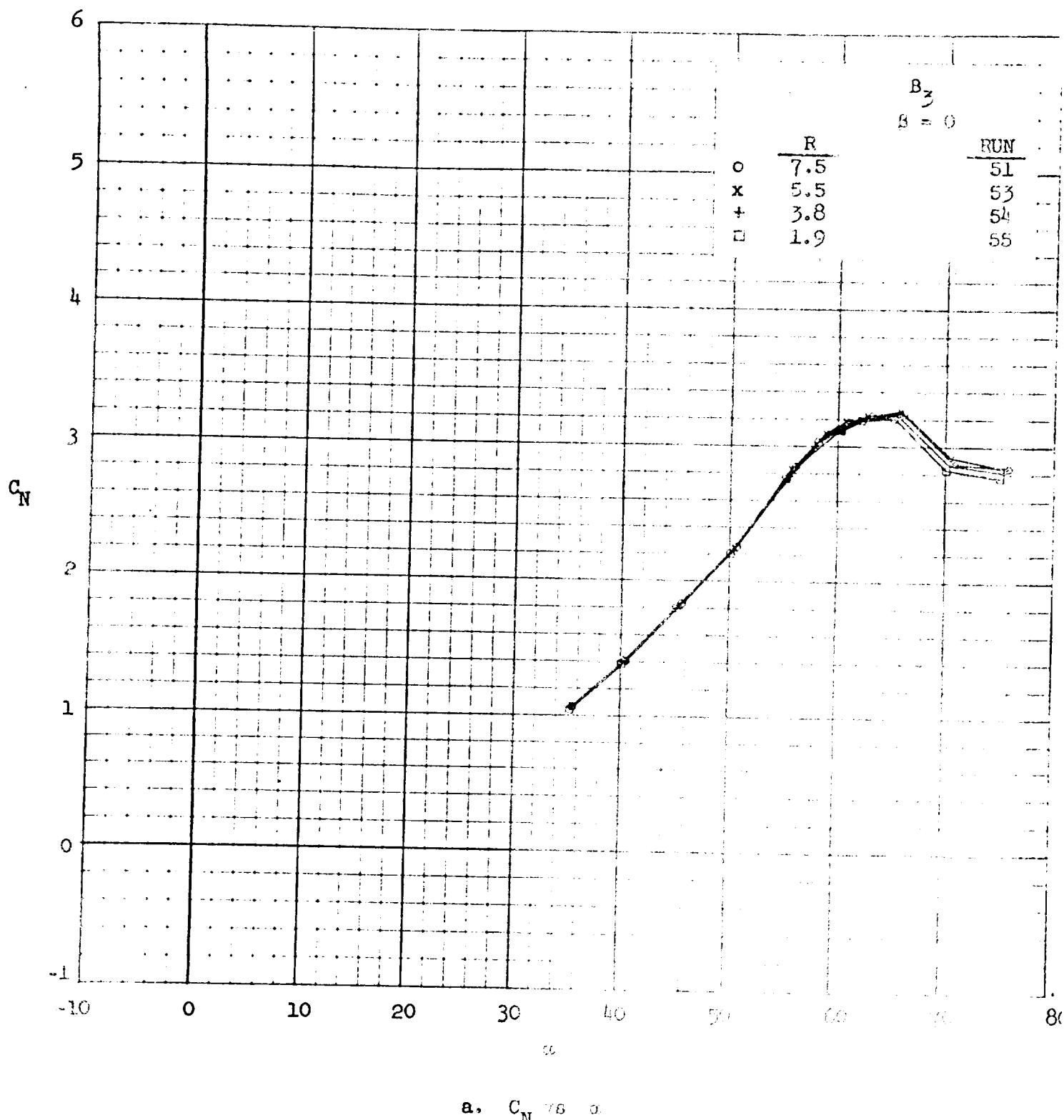


Figure 13. - Concluded

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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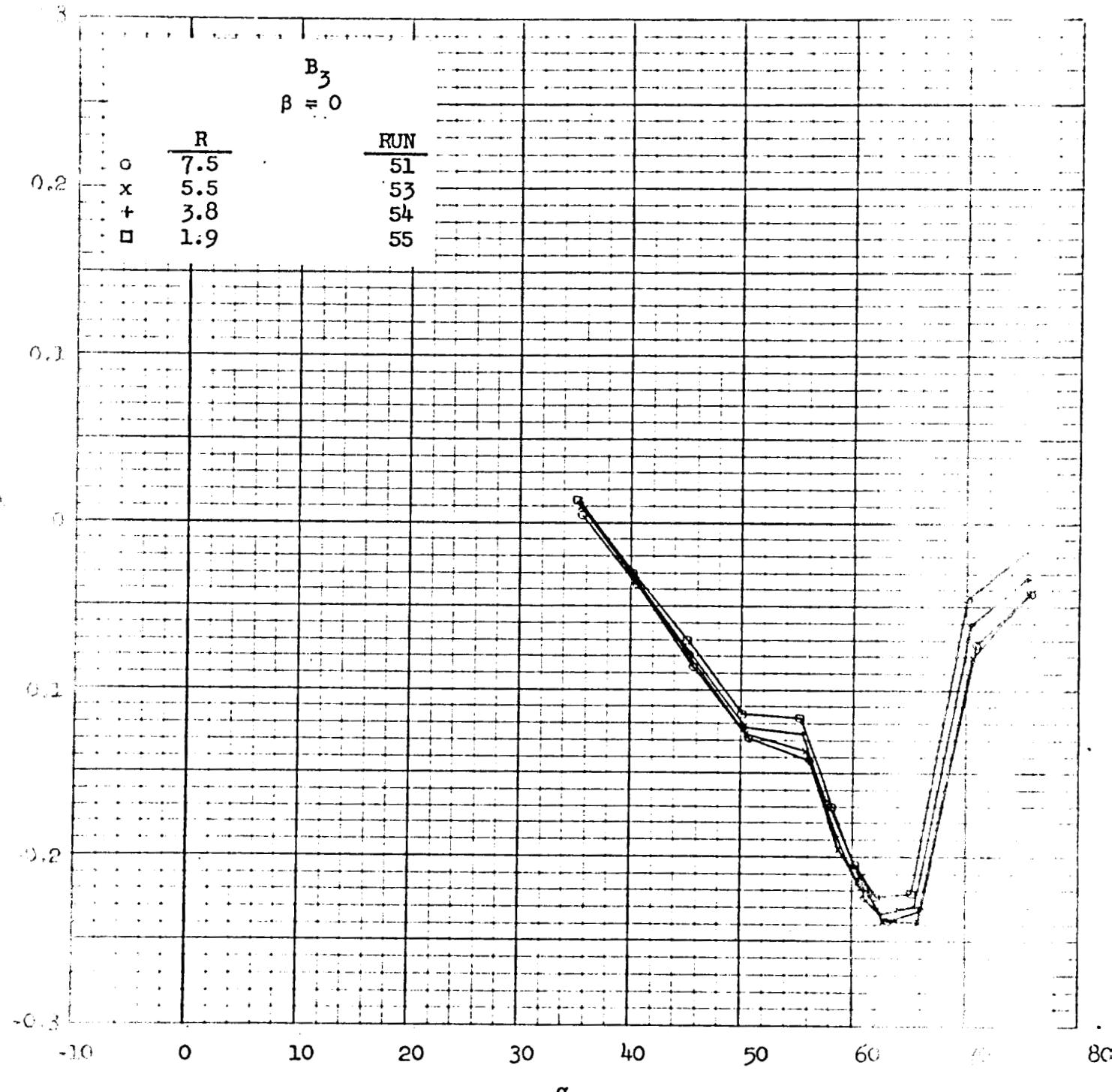


a. C_N vs. α

Figure 14. - Effect of angle of attack on lift coefficient for various Reynolds numbers for $B_z = 0$ (Ref. 13).

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



b. C_A vs α

Figure 14. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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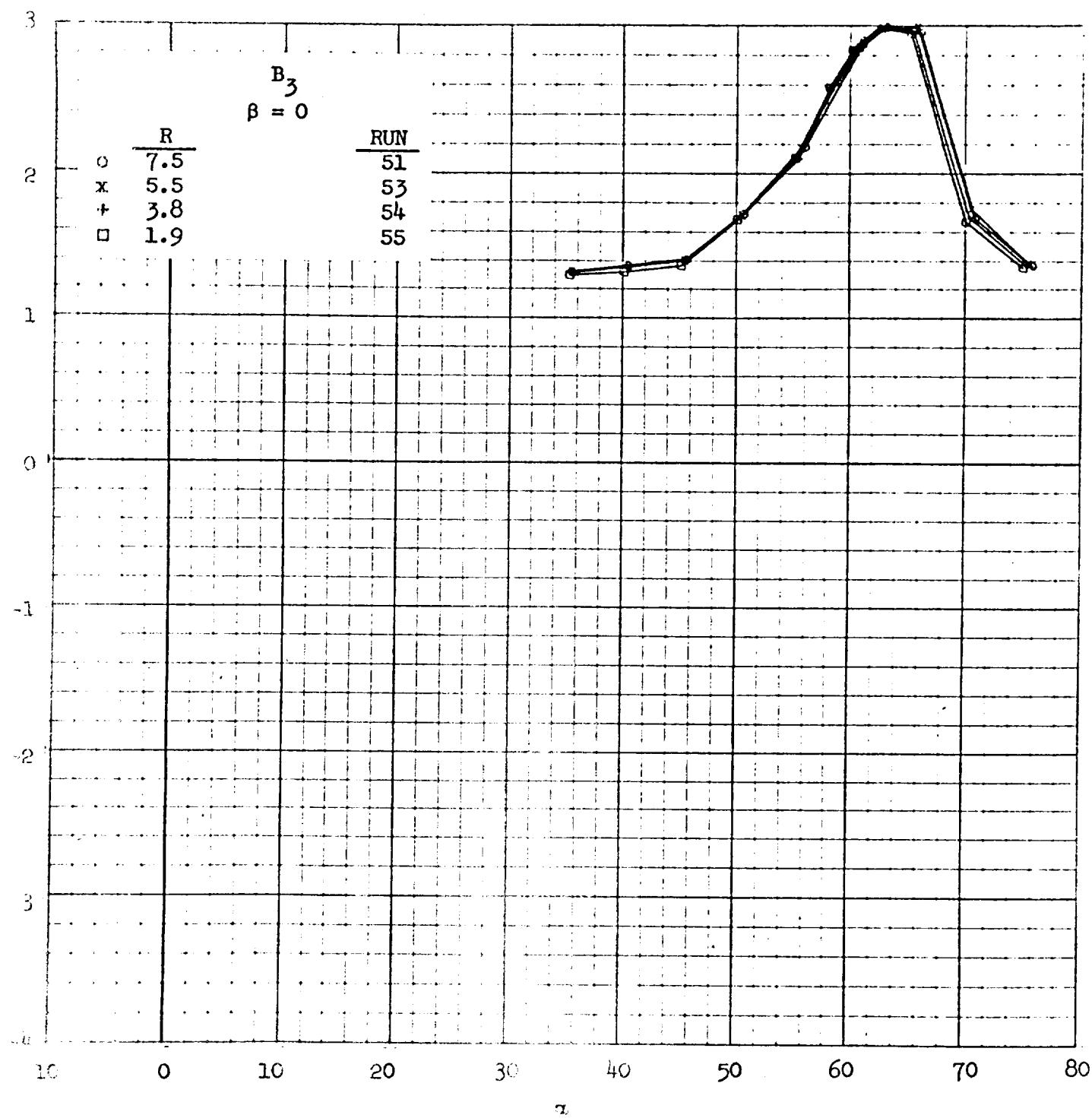


Figure 14. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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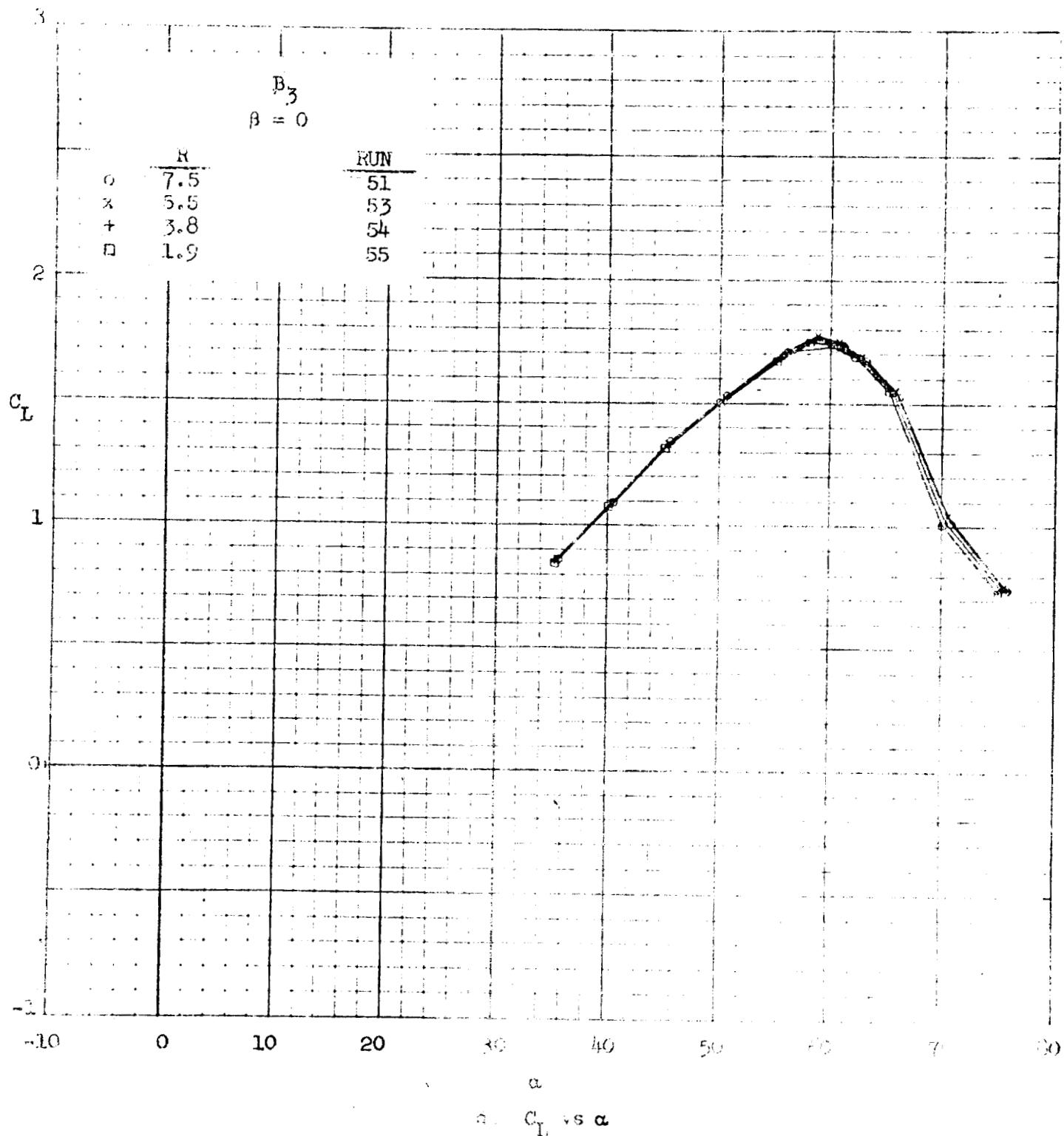
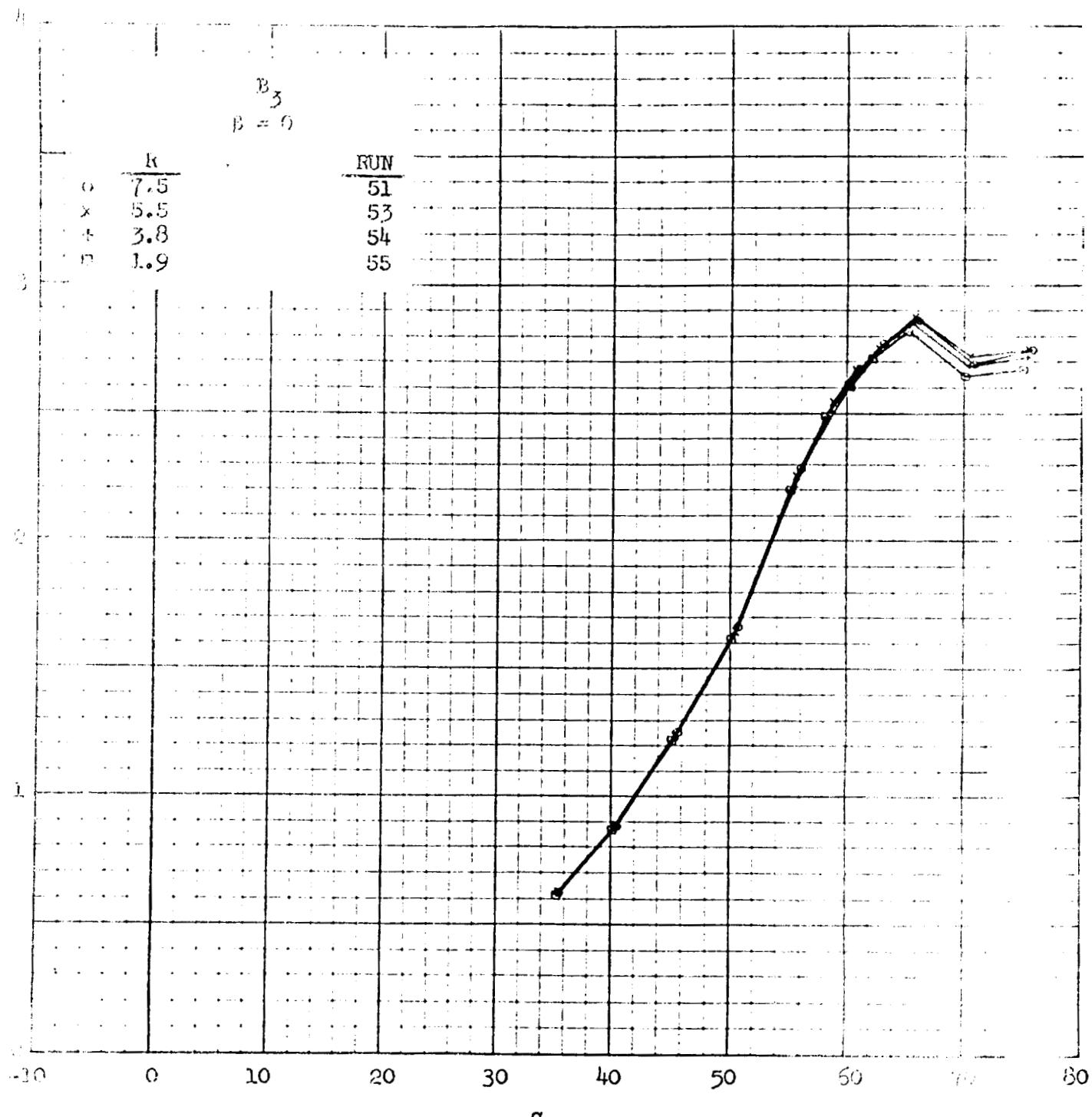


Figure 14. - Continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



e. C_D vs α

Figure 14. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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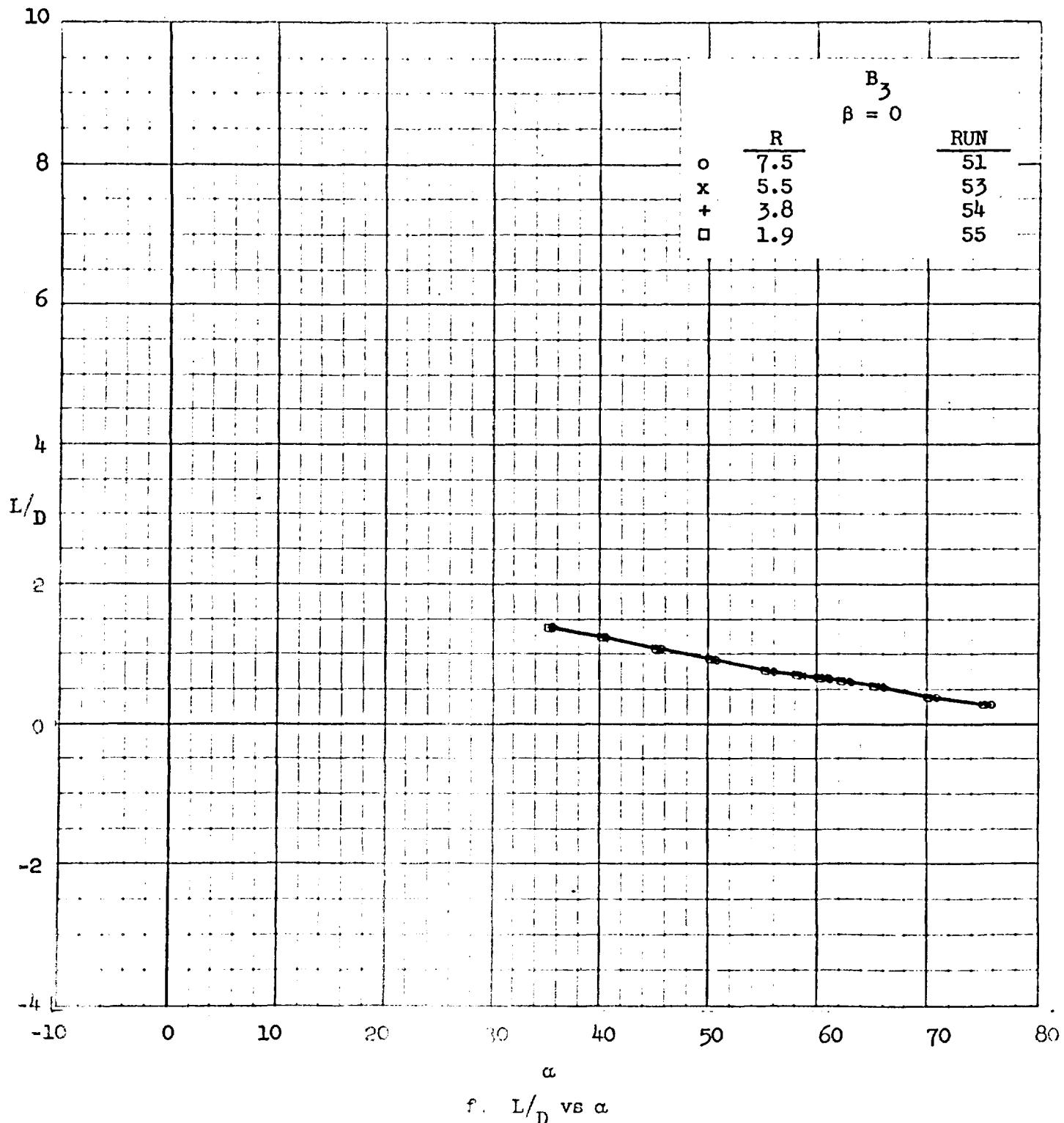


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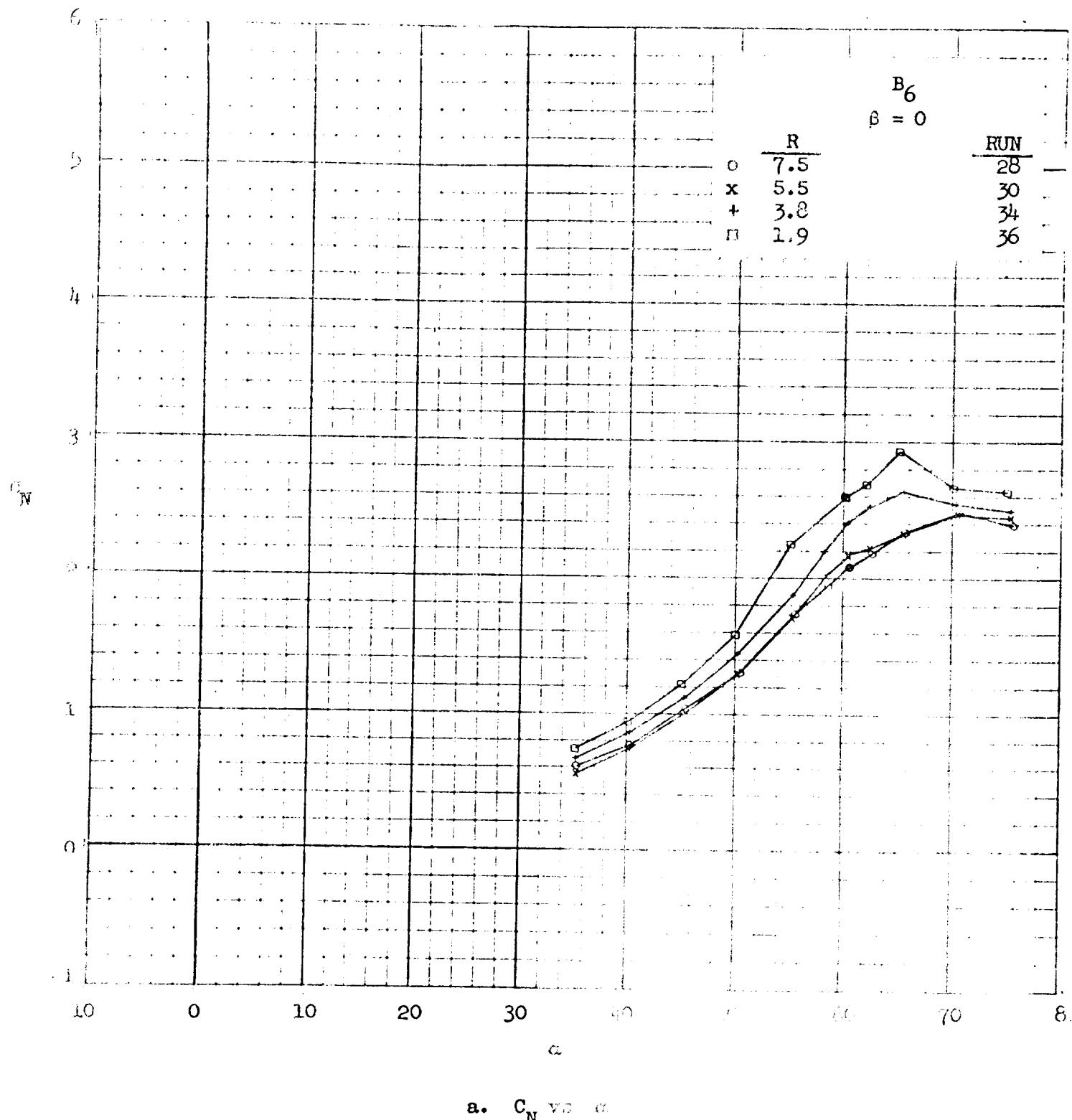
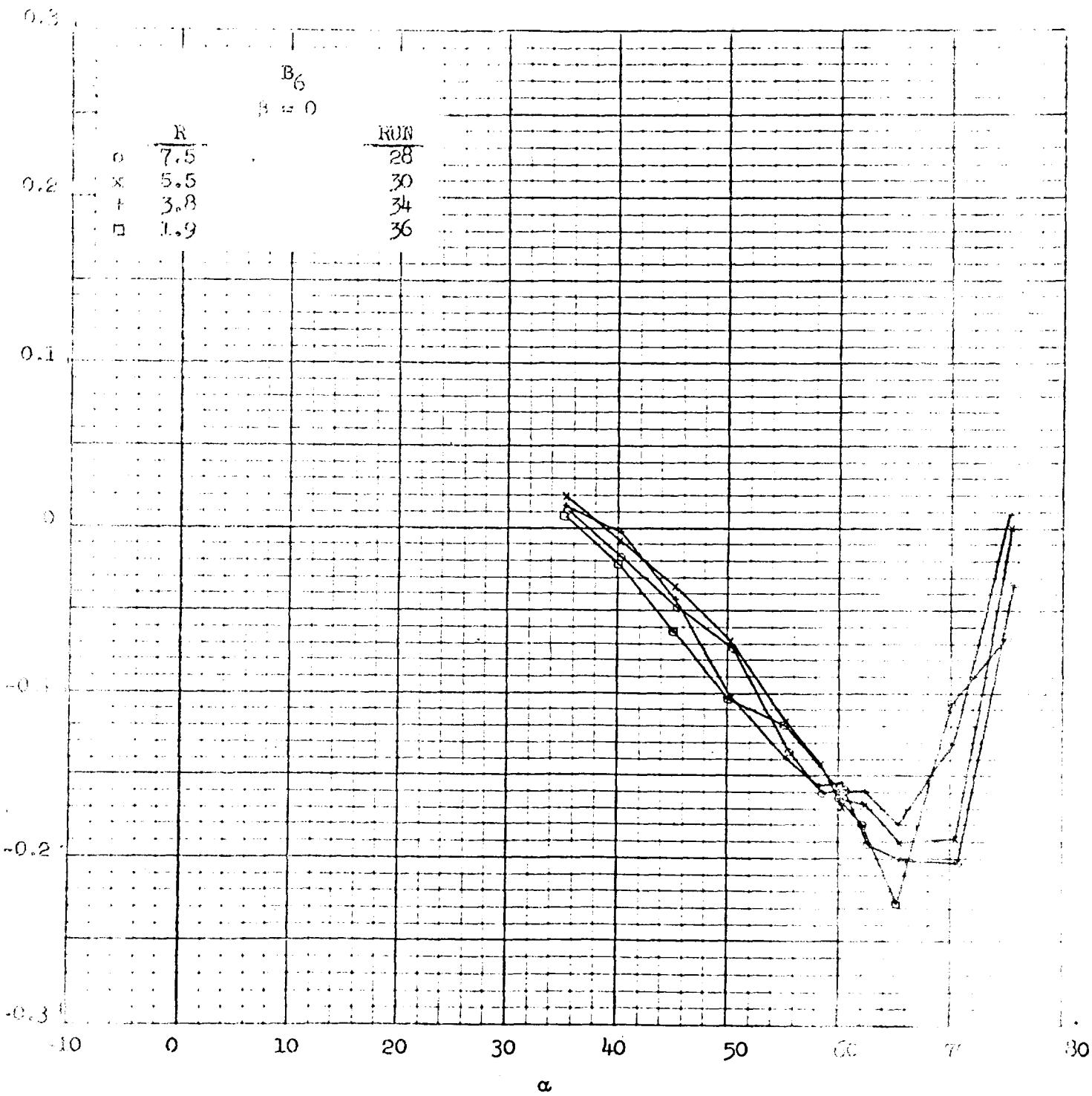


Figure 15. - Effect of angle of attack on lift coefficient chart for various Reynolds numbers for configuration B₆ = 0.

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



b. C_A vs α

Figure 15. ~ continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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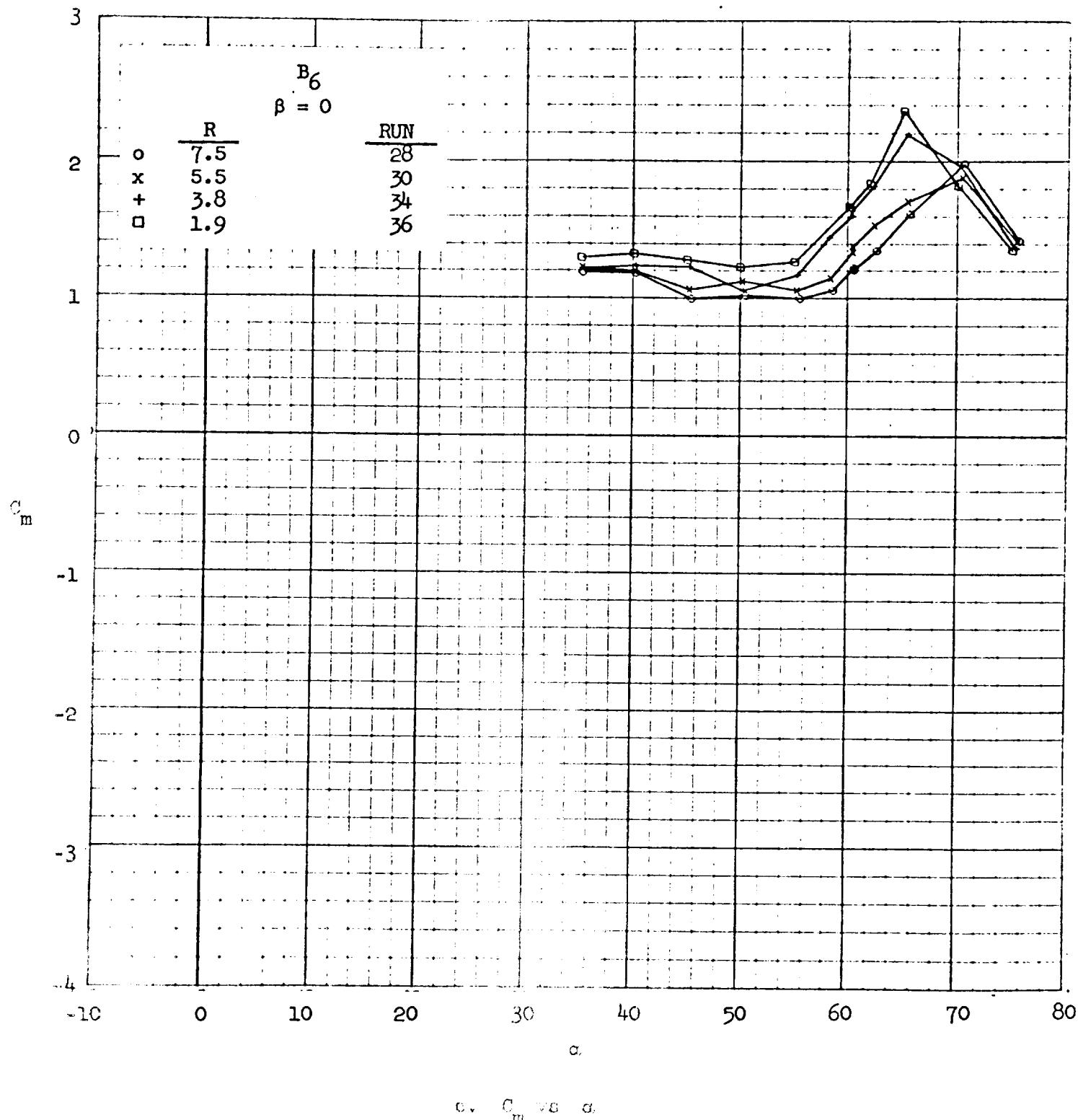


Figure 15. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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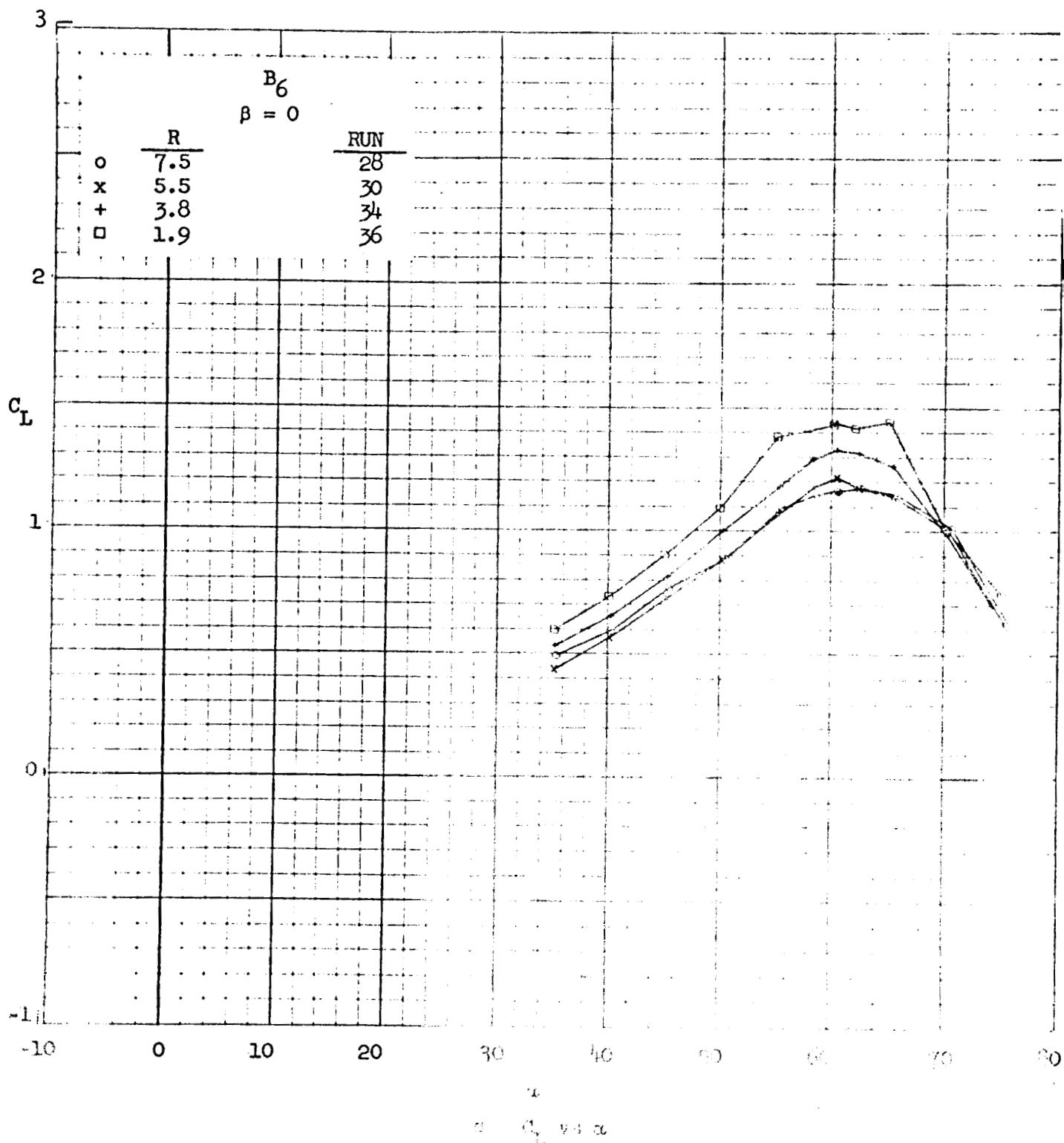
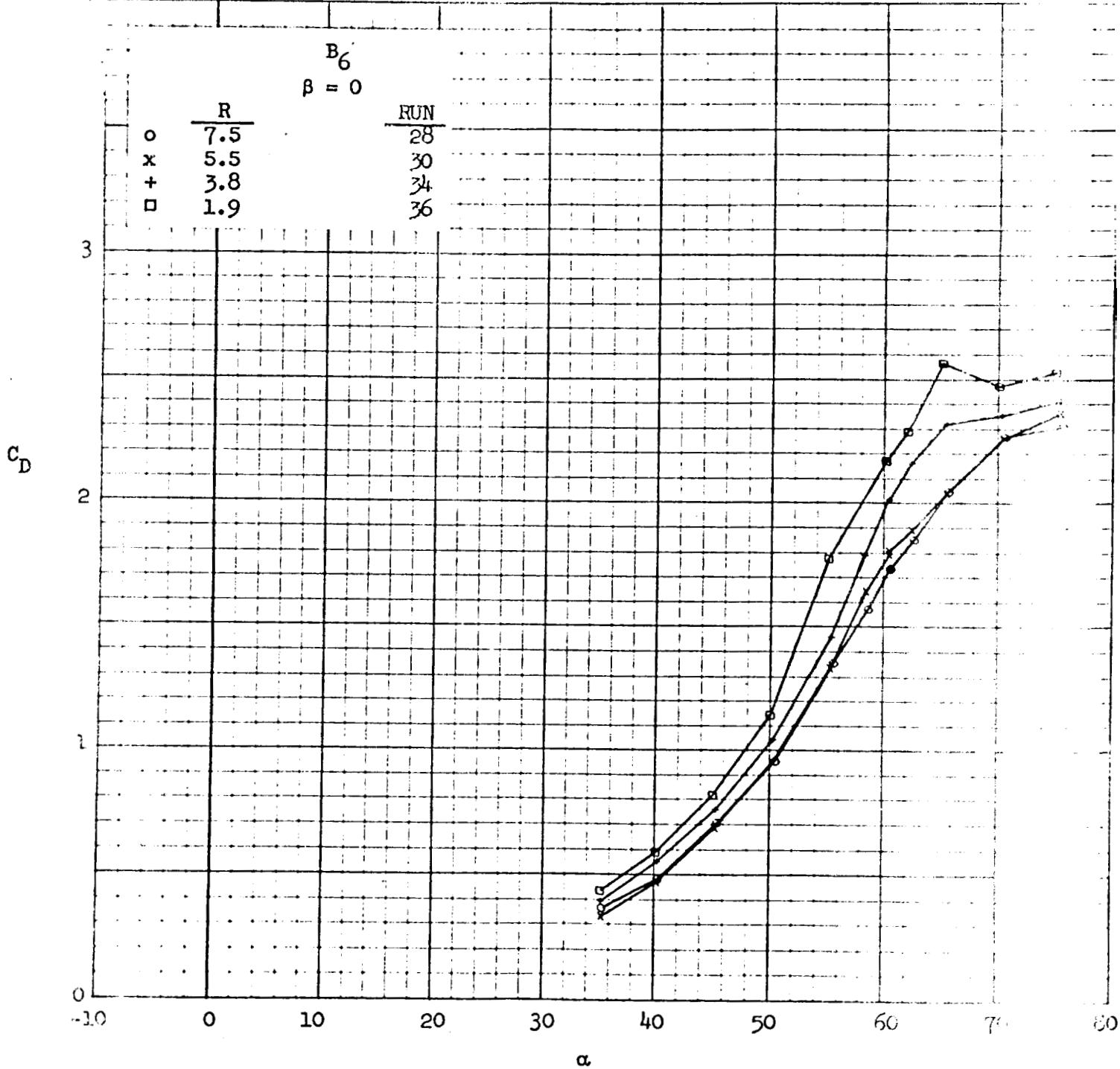


Figure 15. - Continued

National Aeronautics and Space Administration
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e. C_D vs α

Figure 15. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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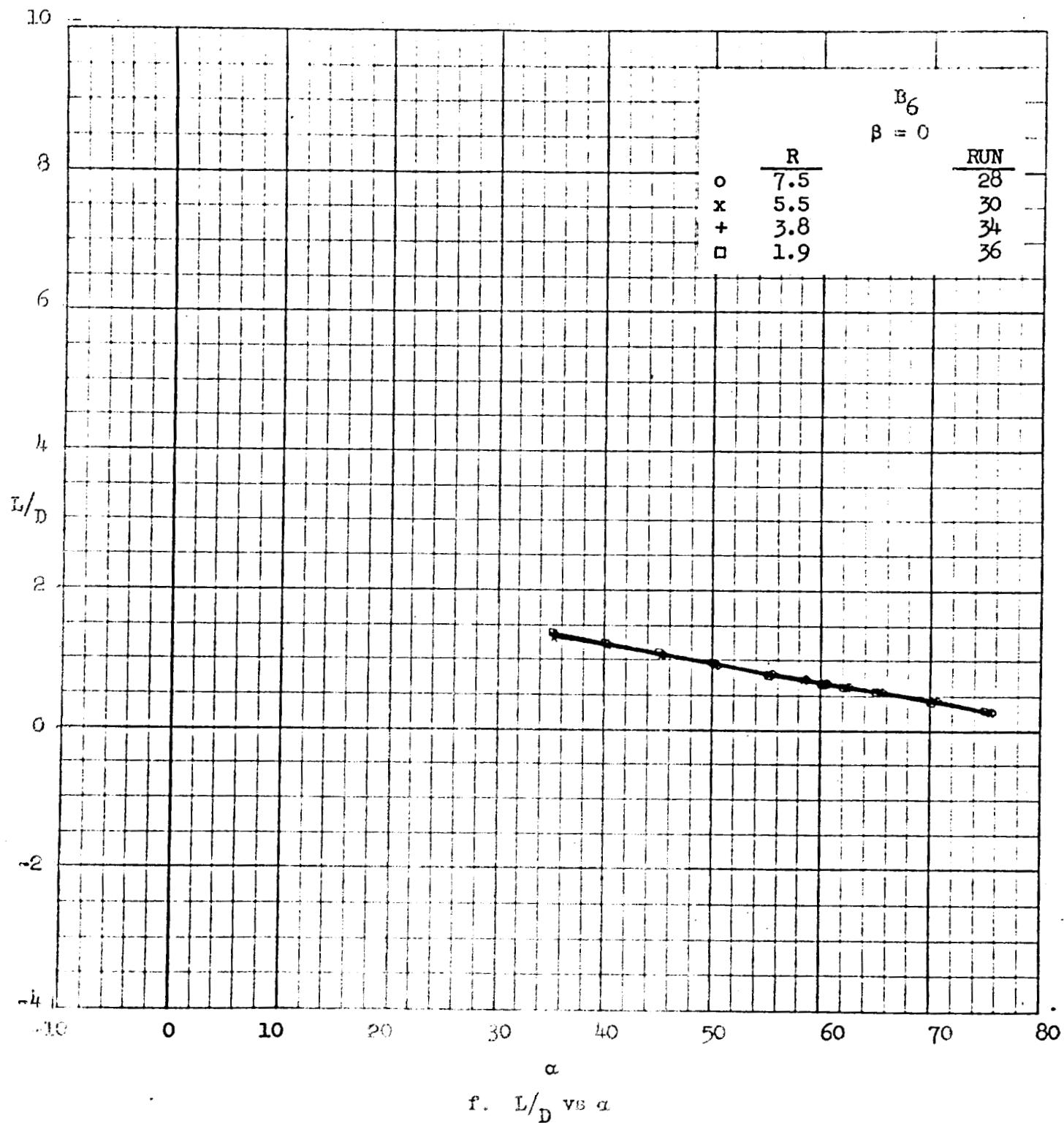


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National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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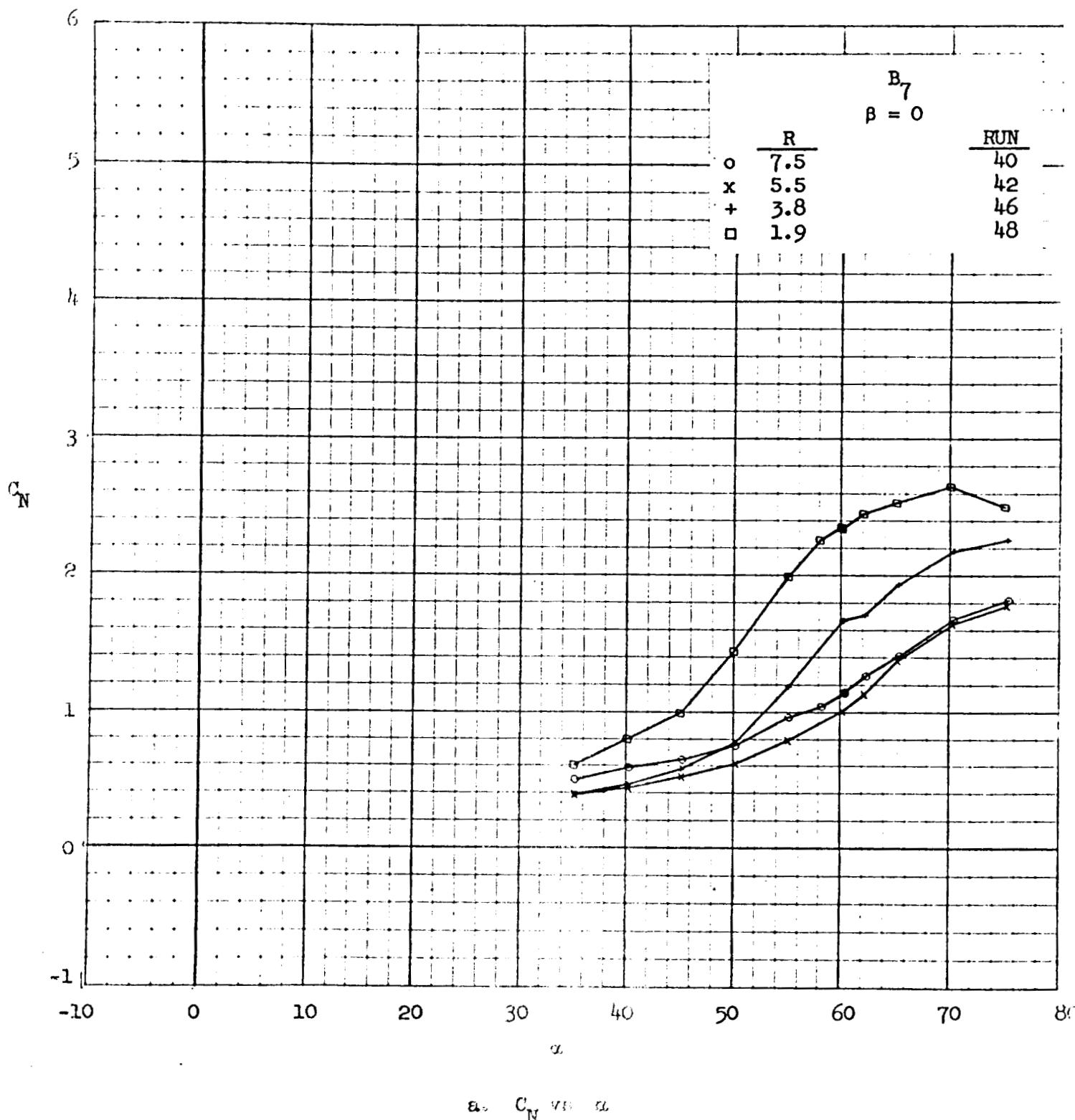
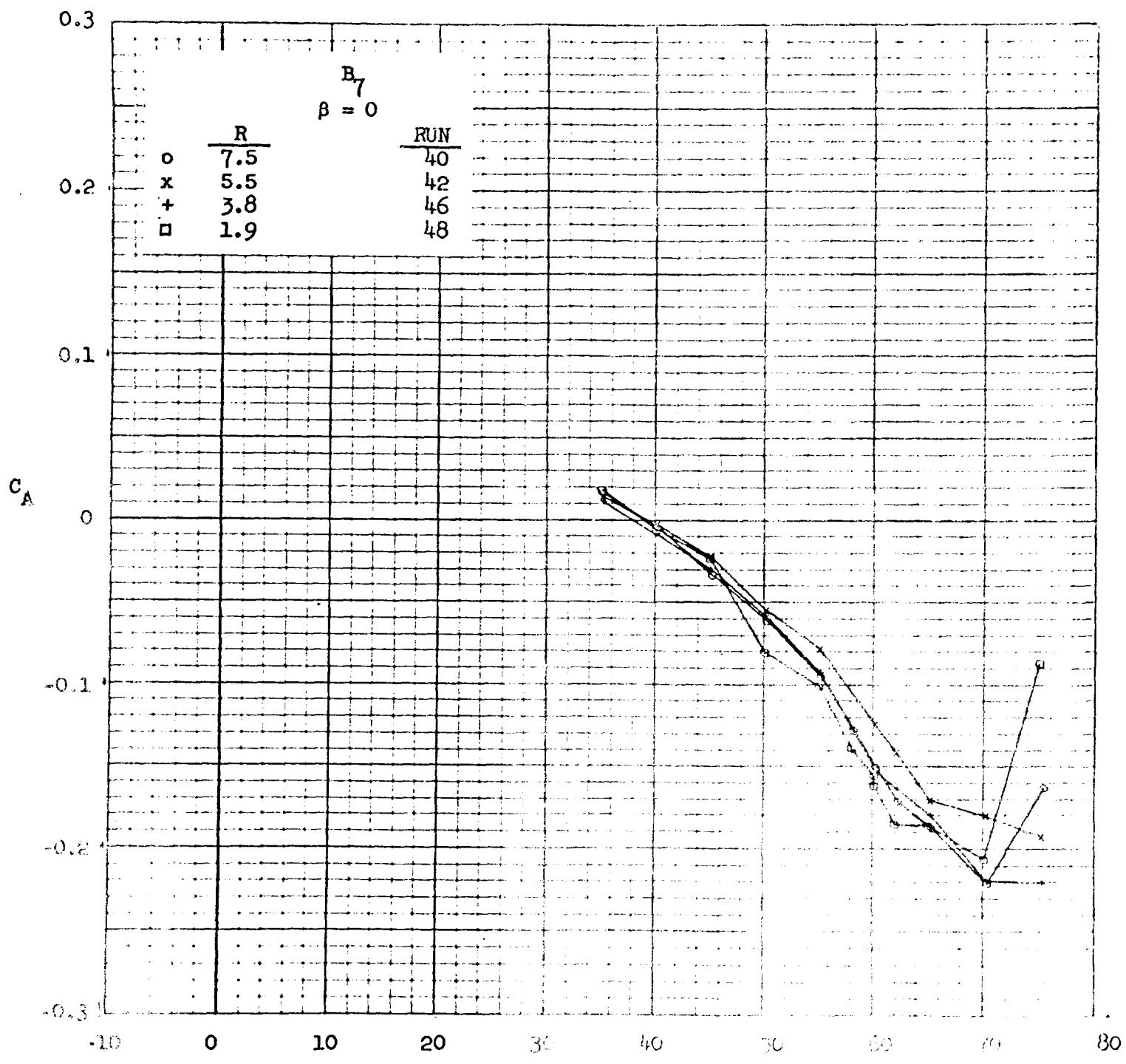


Figure 16. - Effect of angle of attack on longitudinal characteristics of various Reynolds numbers for body only configuration, B_7 .

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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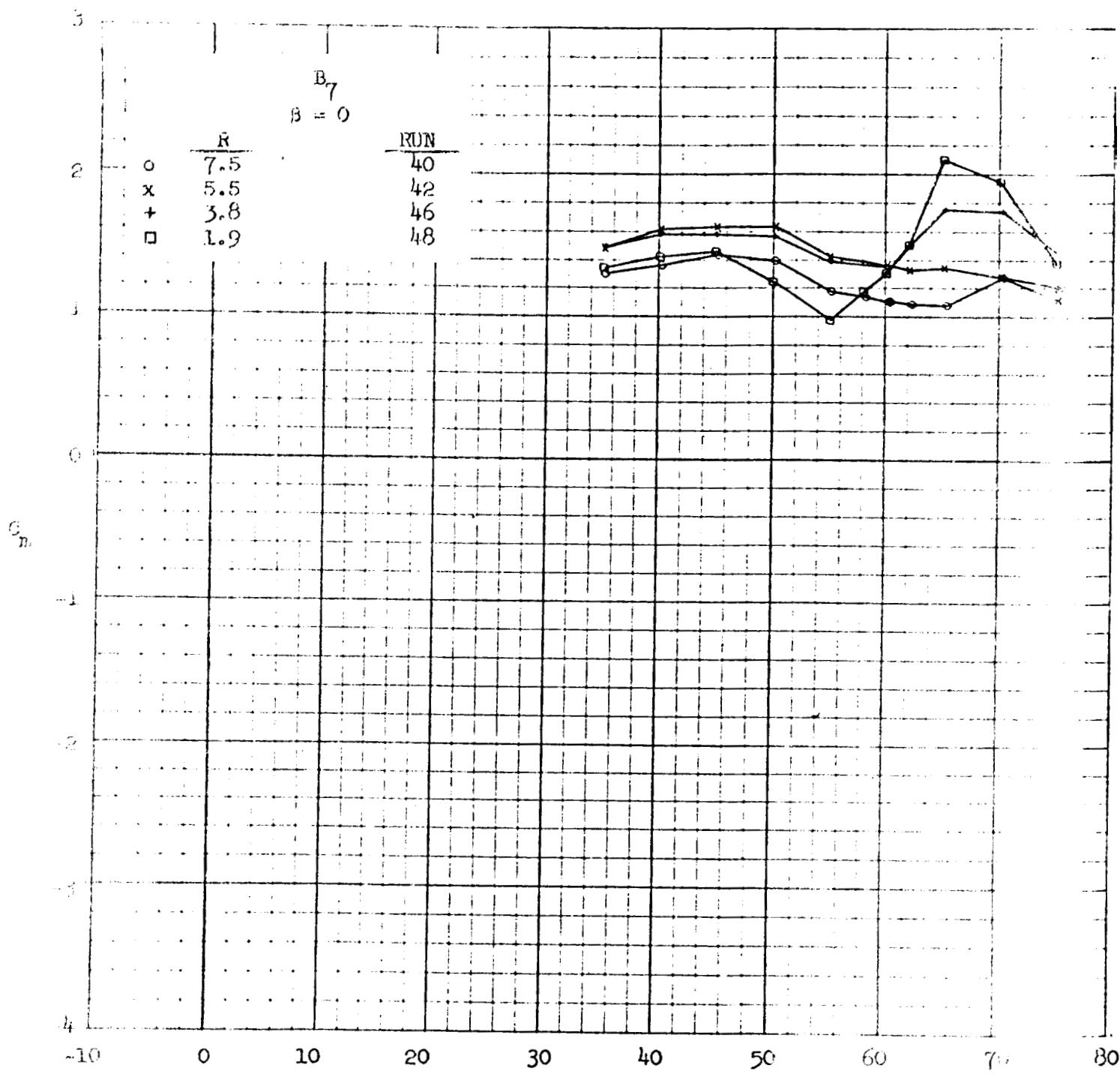


b. C_A vs α

Figure 16. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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c. C_m vs α

Figure 16. -- continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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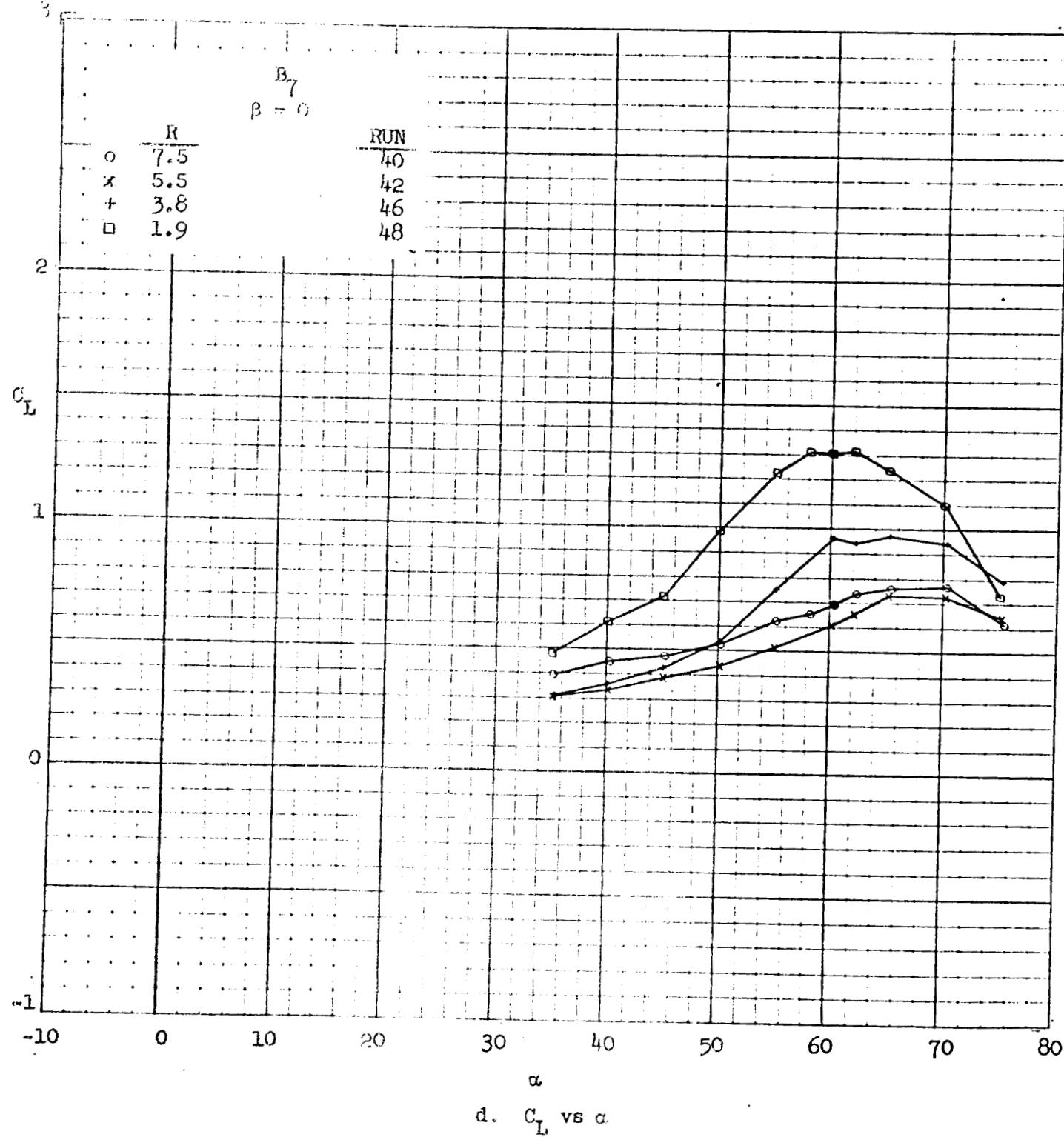
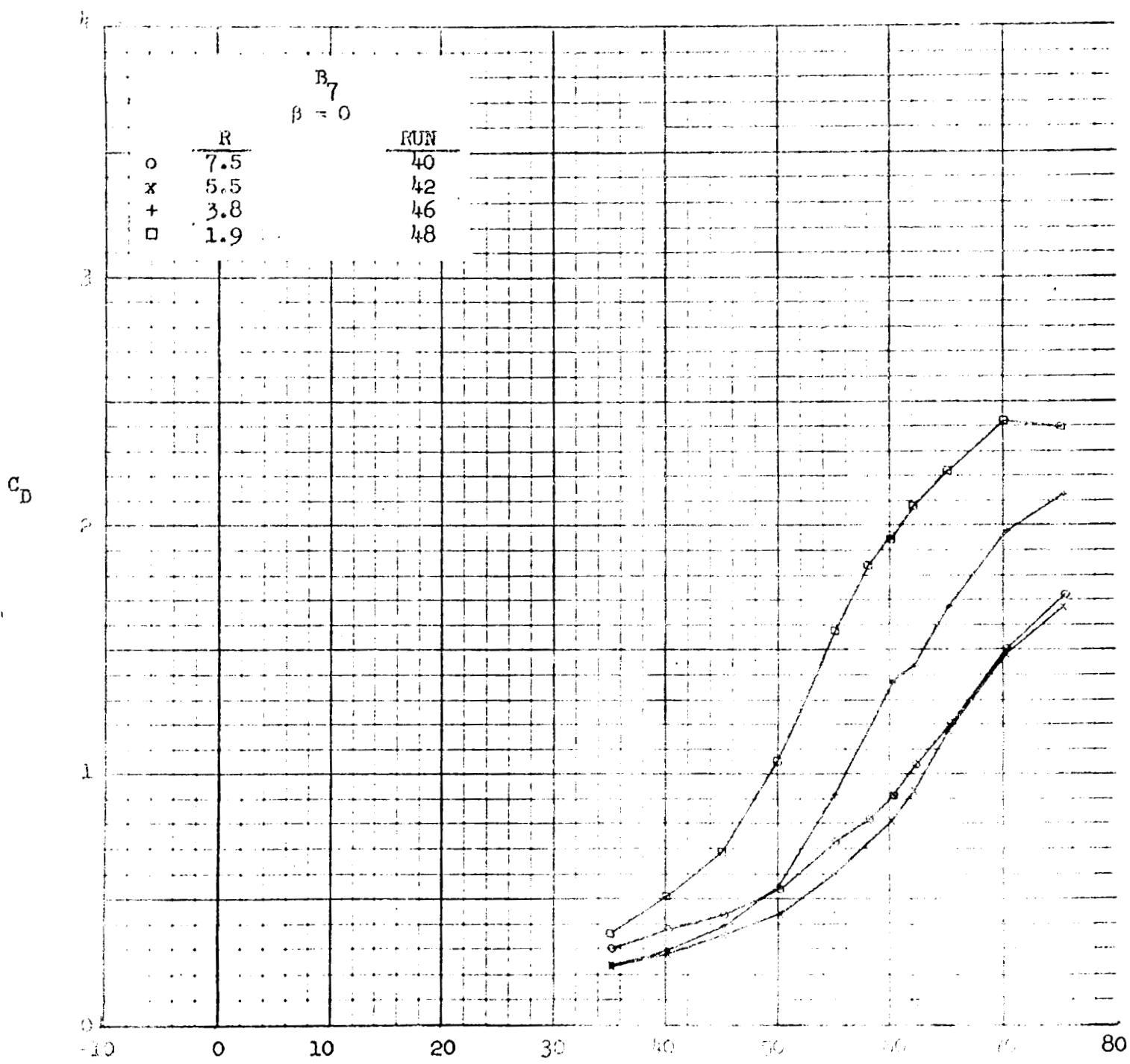


Figure 16 . - Continued

National Aeronautics and Space Administration
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e. C_D vs. α

Figure 16. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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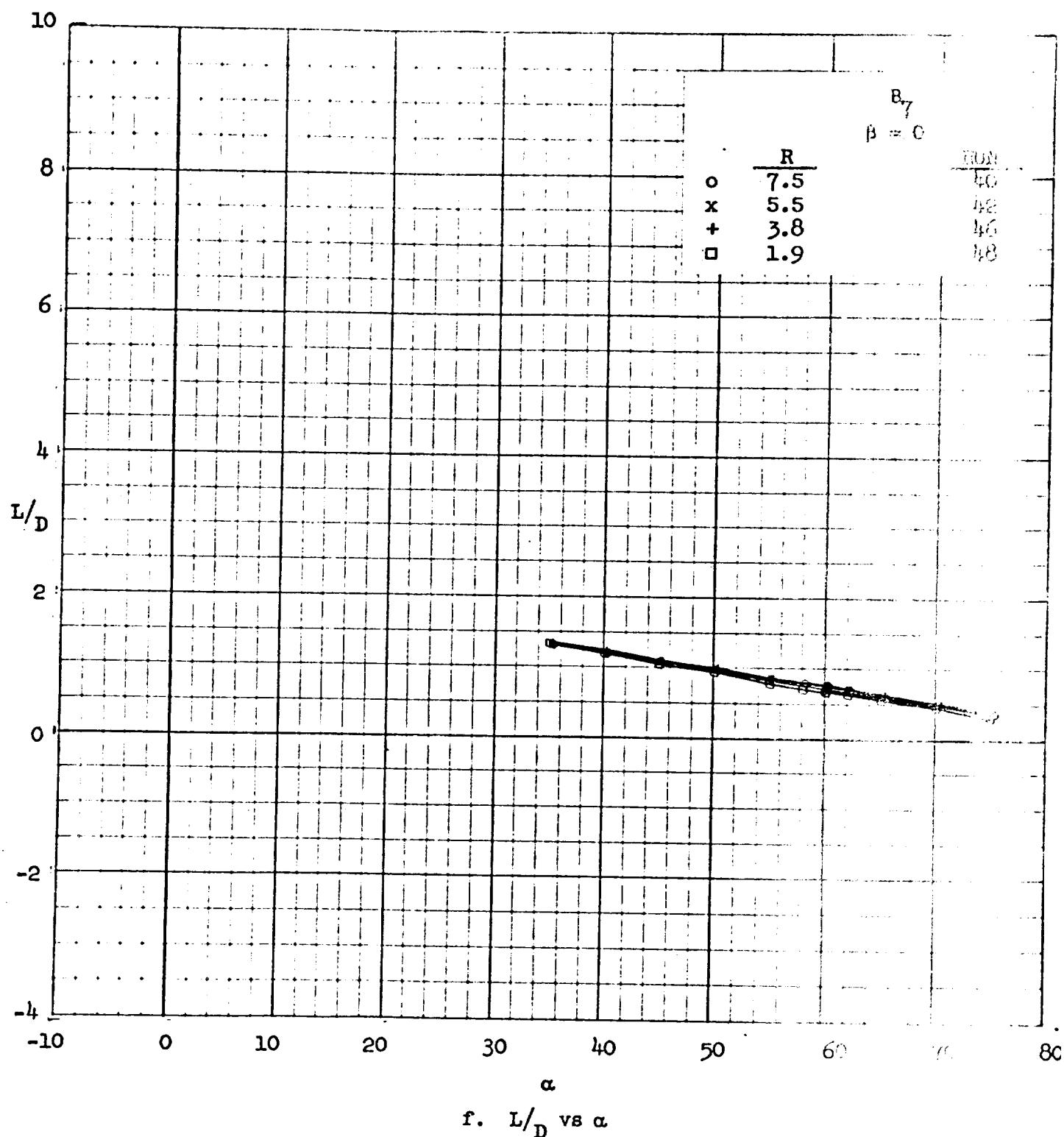


Figure 16. - Concluded

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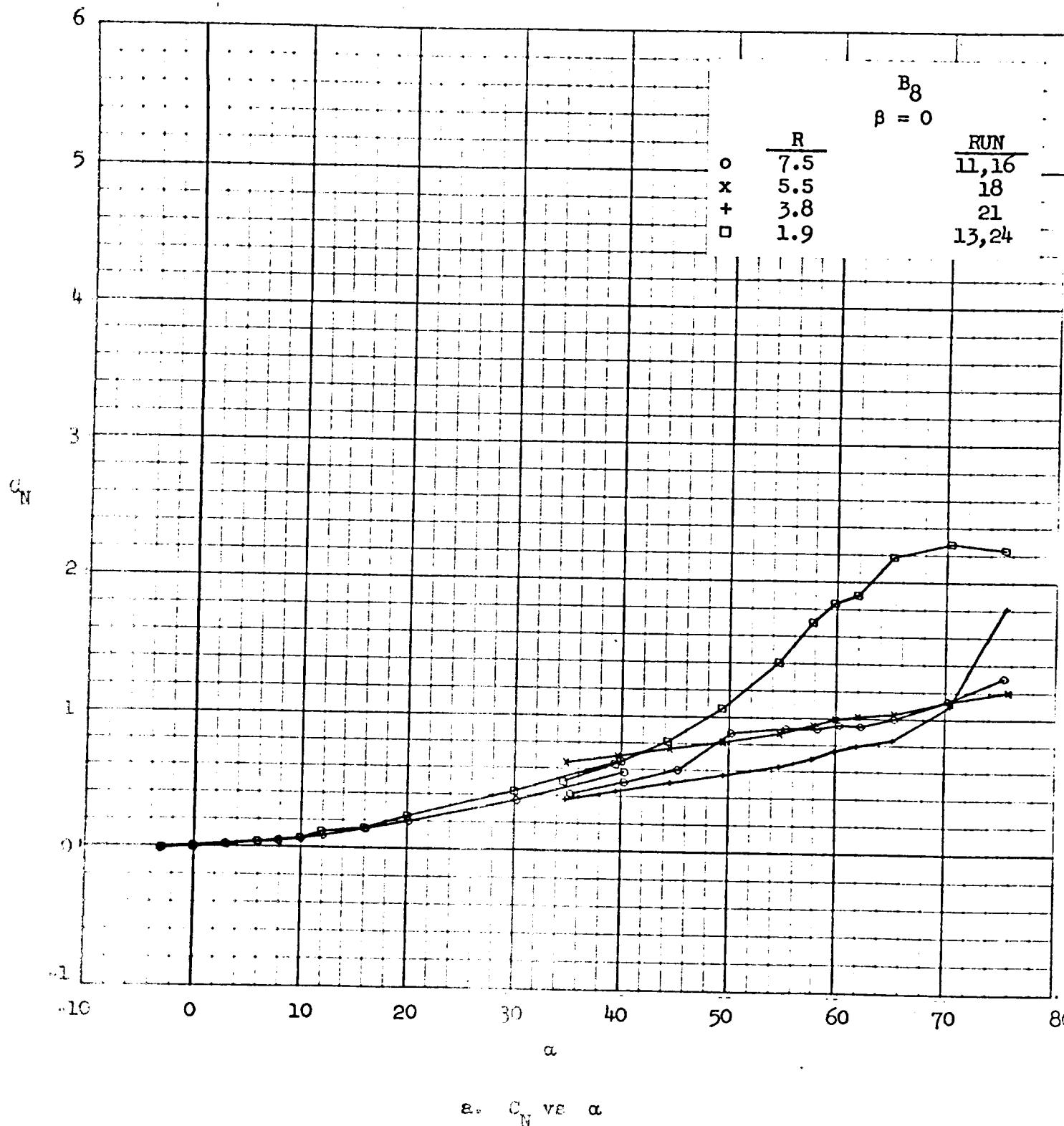
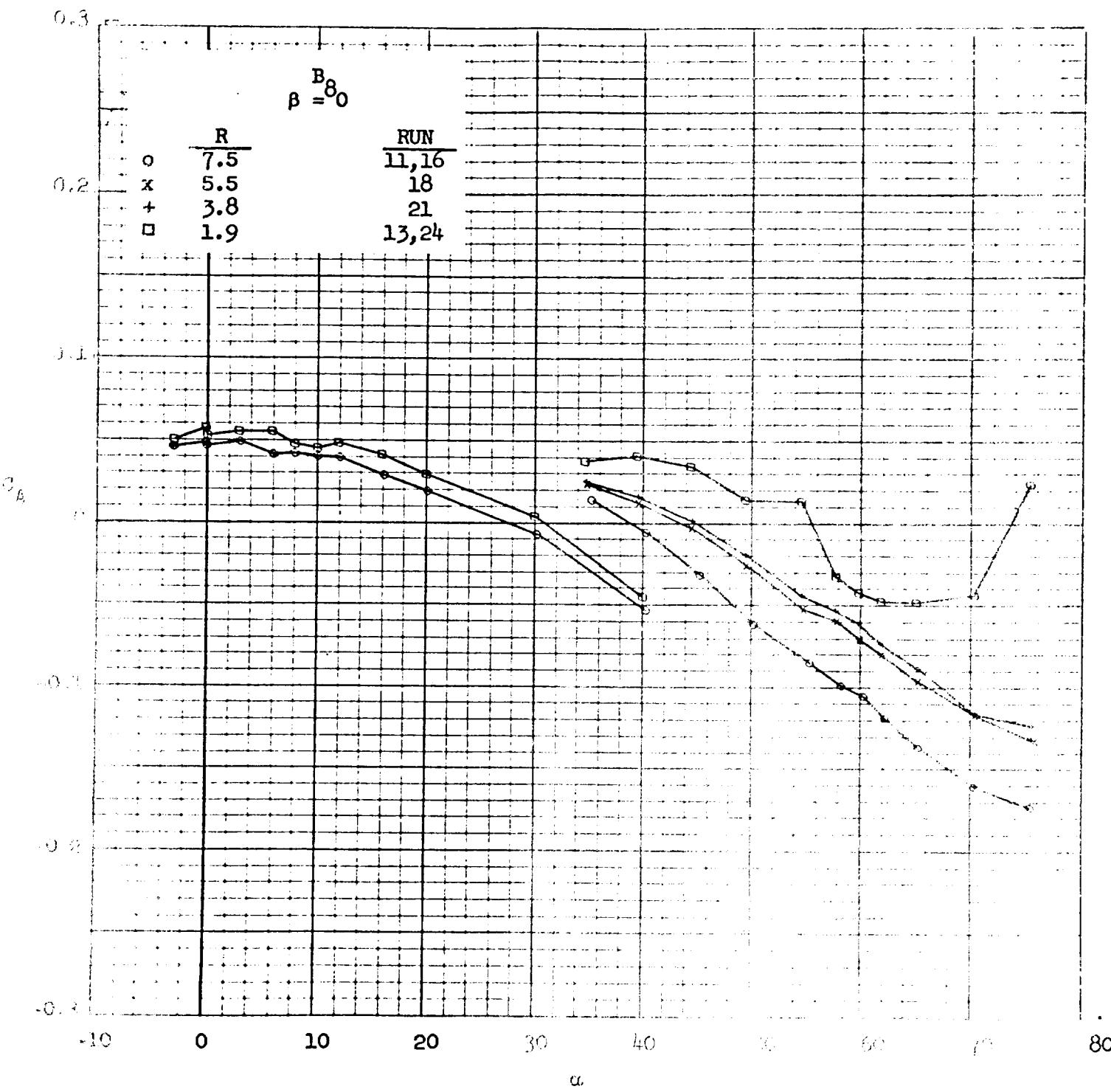


Figure 17. - Effect of angle of attack on longitudinal characteristics of various Reynolds numbers for body only configuration, B_8 .

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Ames Research Center: MOFFETT FIELD, CALIF.
PRELIMINARY DATA



b. C_L vs α

Figure 17. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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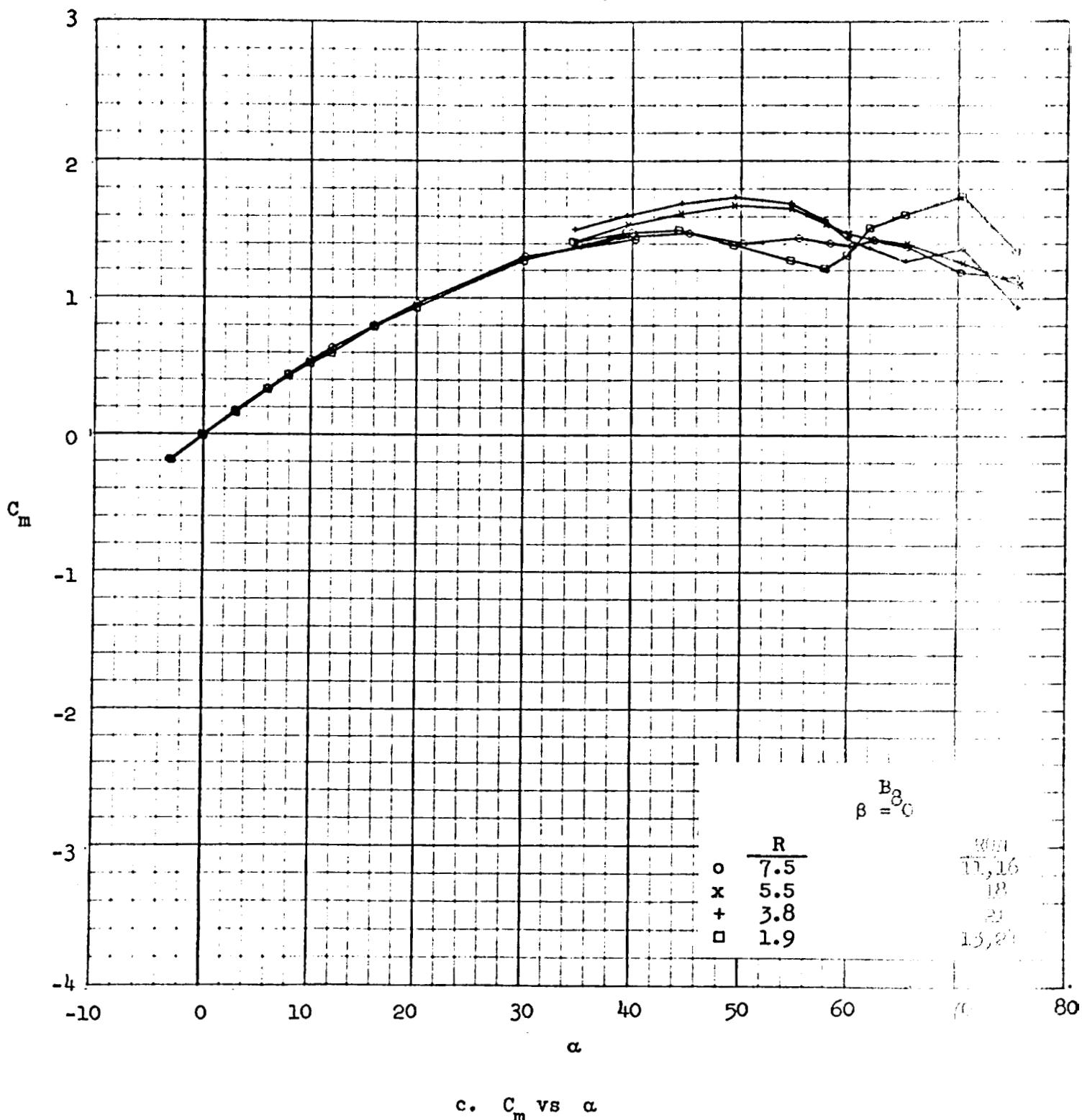


Figure 17. - continued

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Ames Research Center: MOFFETT FIELD, CALIF.

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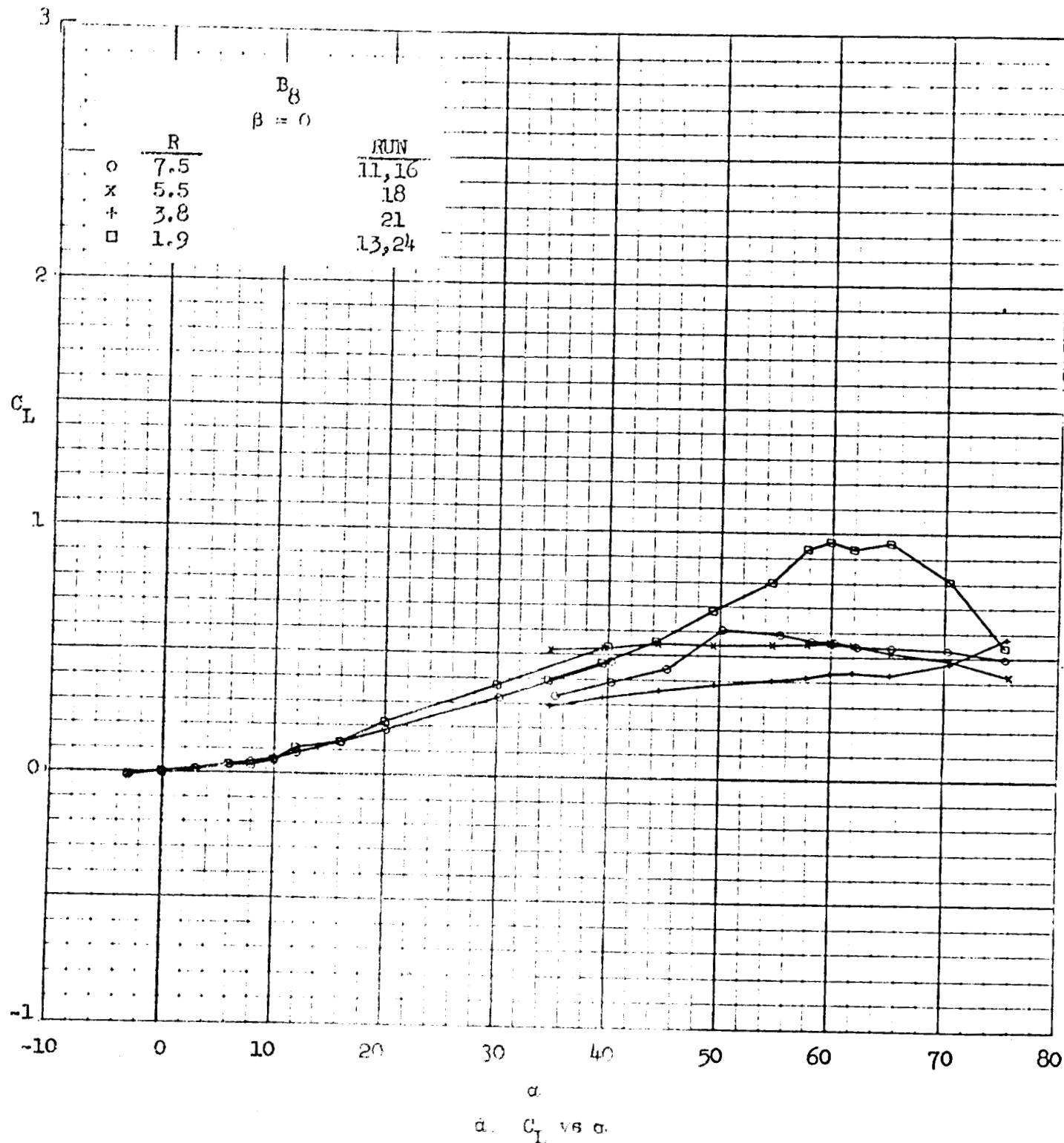


Figure 17 - Continued

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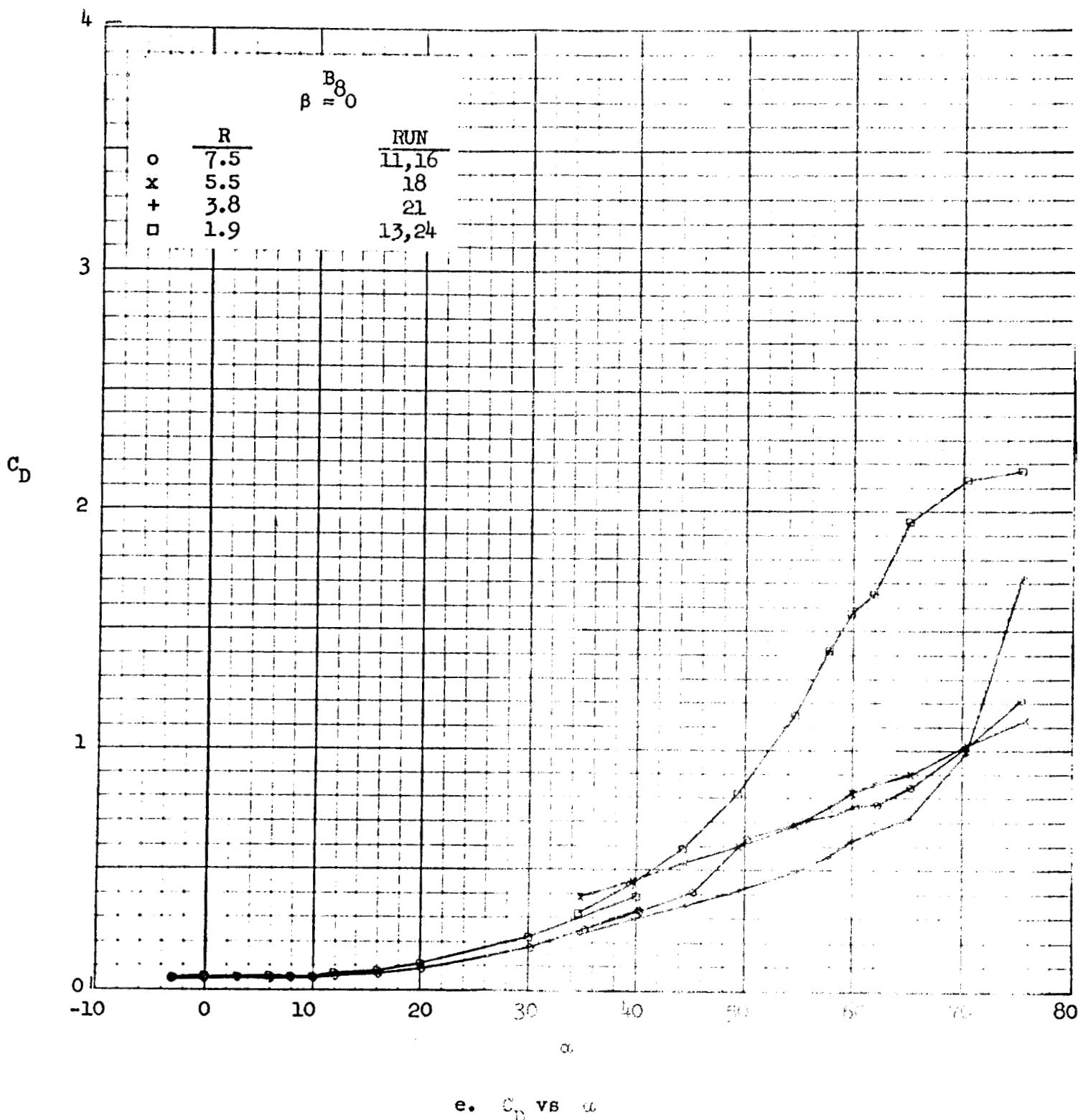


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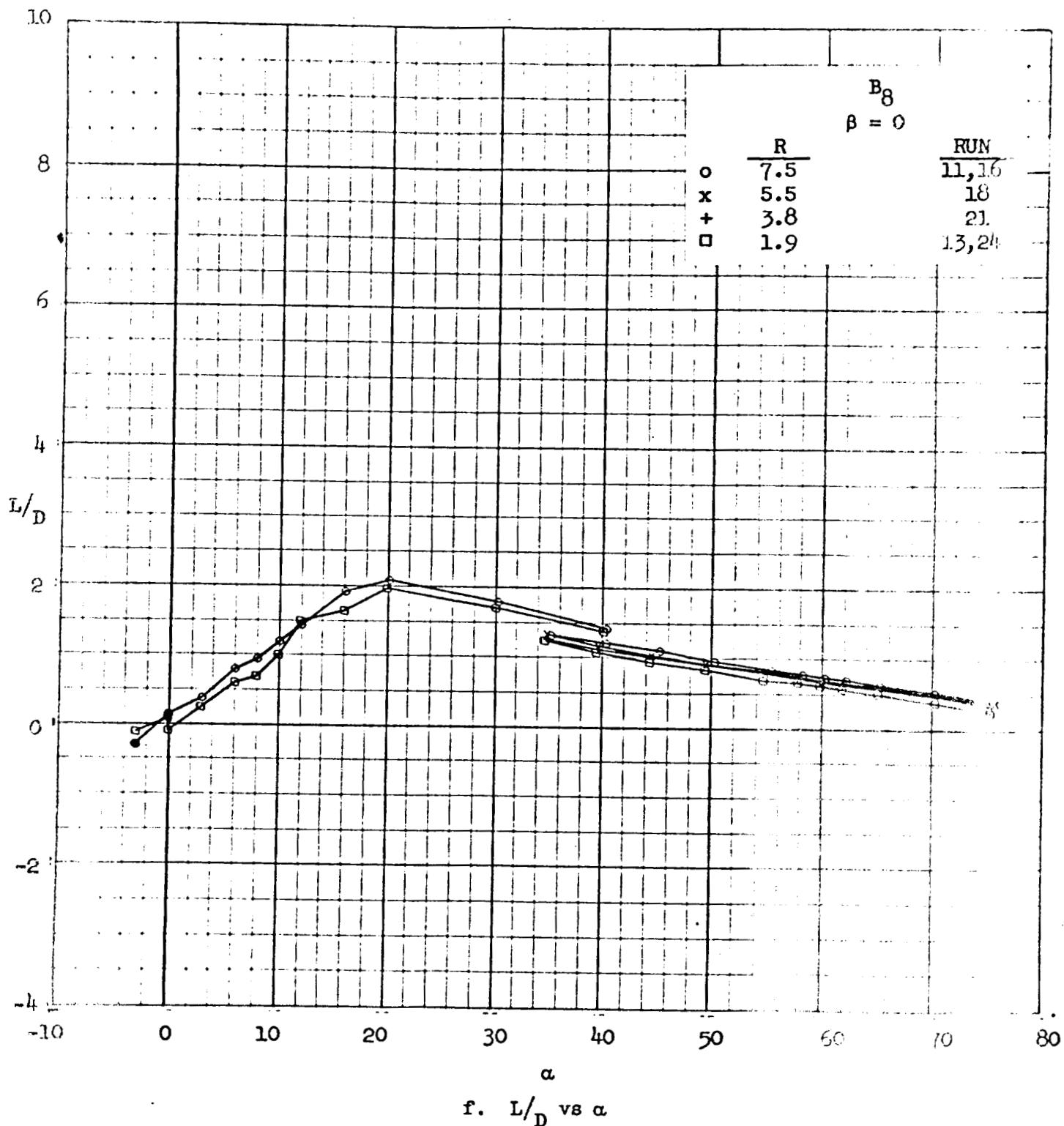


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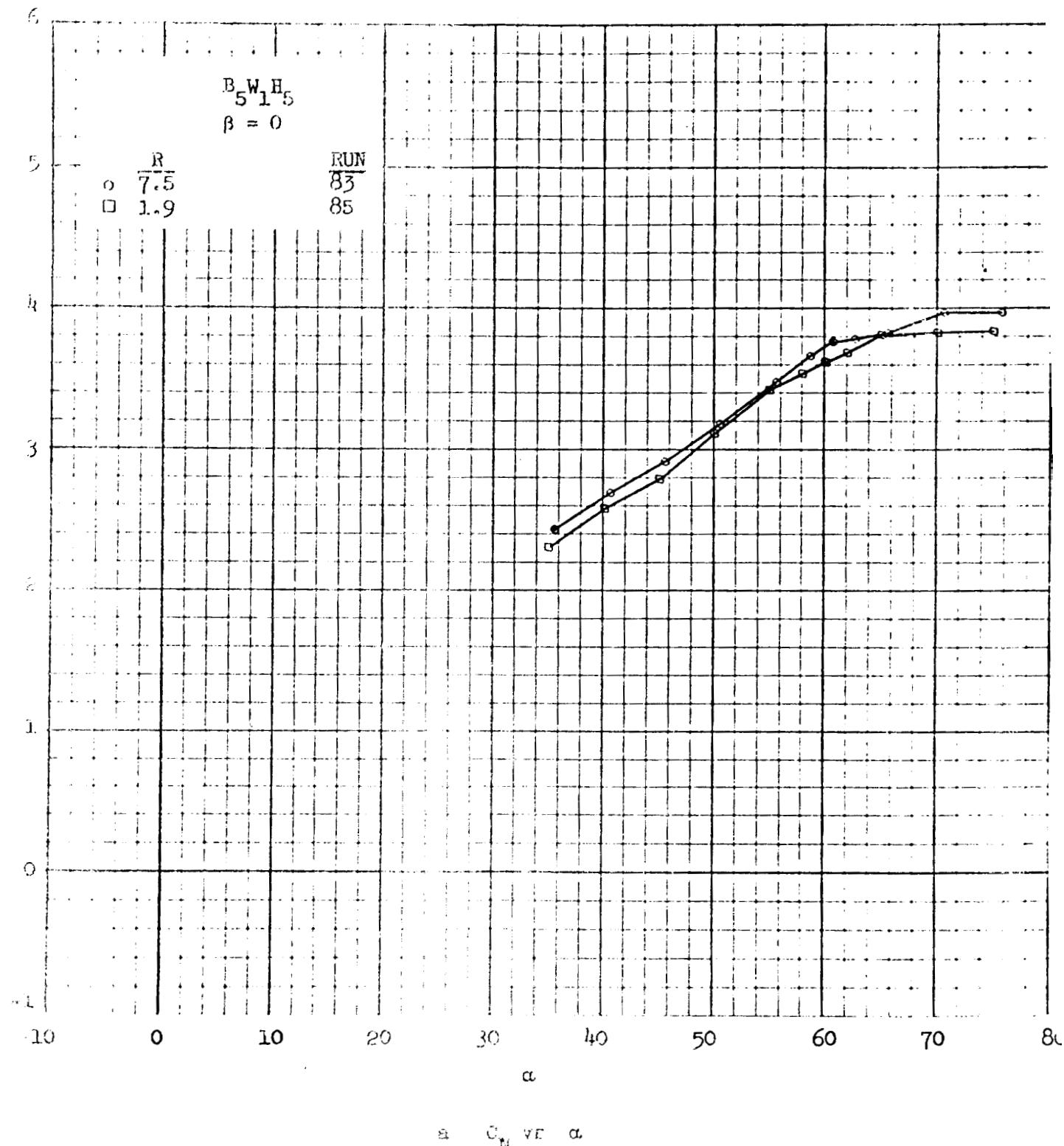
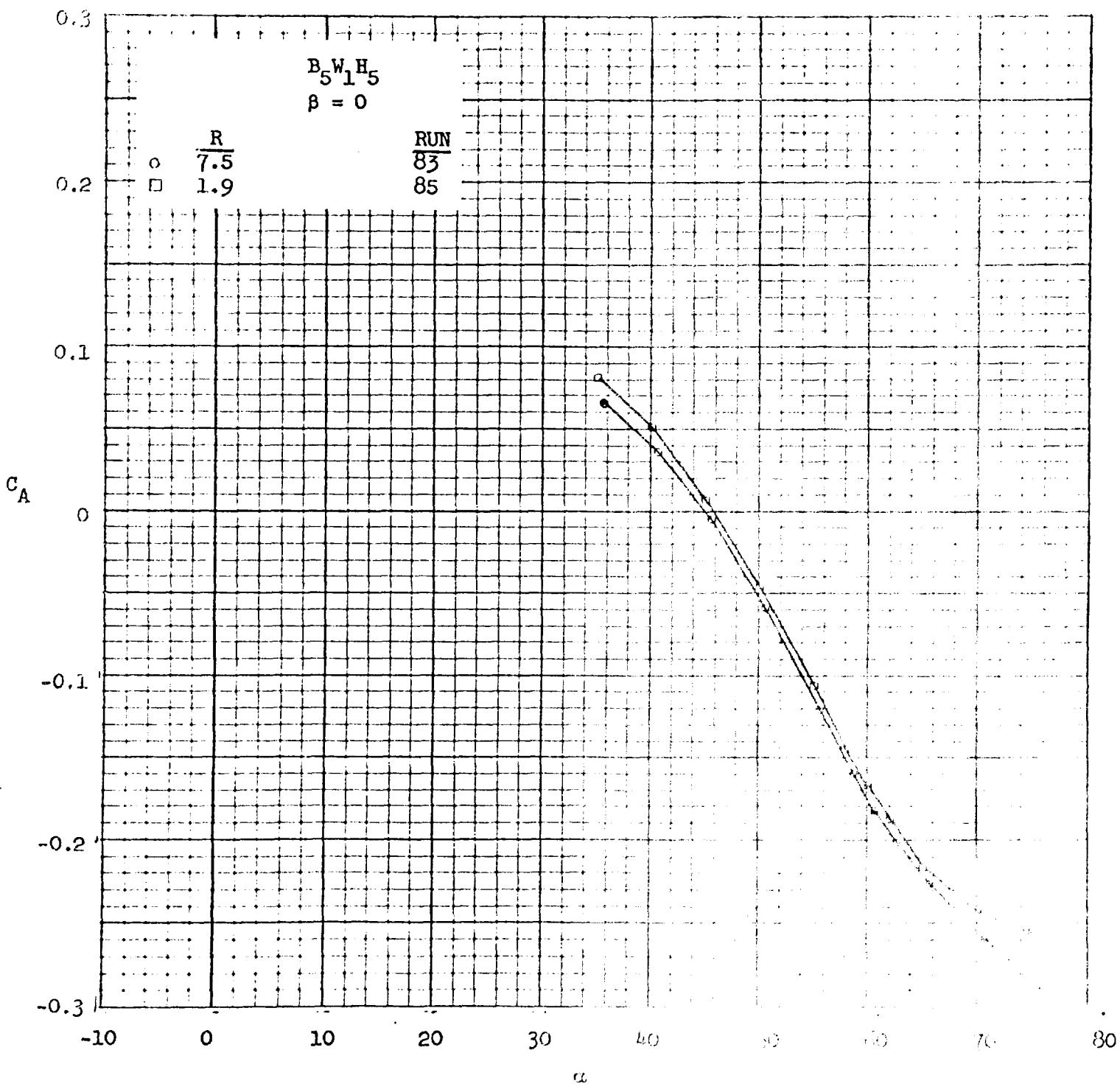


Figure 18. - Effect of angle of attack on longitudinal characteristics at various Reynolds numbers for several model configurations, $B_5W_1H_5$.

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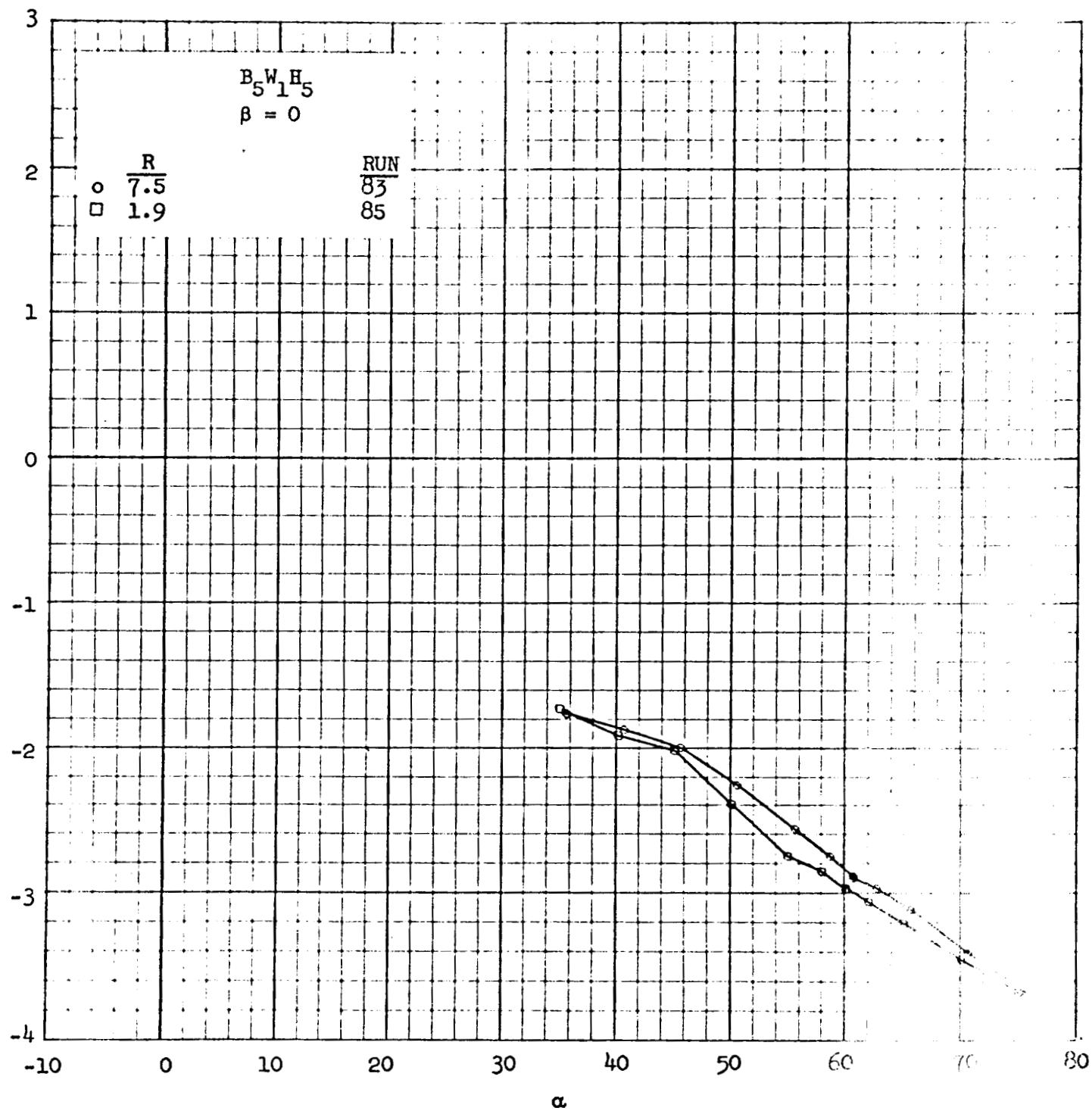


b. C_A vs α

Figure 18. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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c. C_m vs α

Figure 18. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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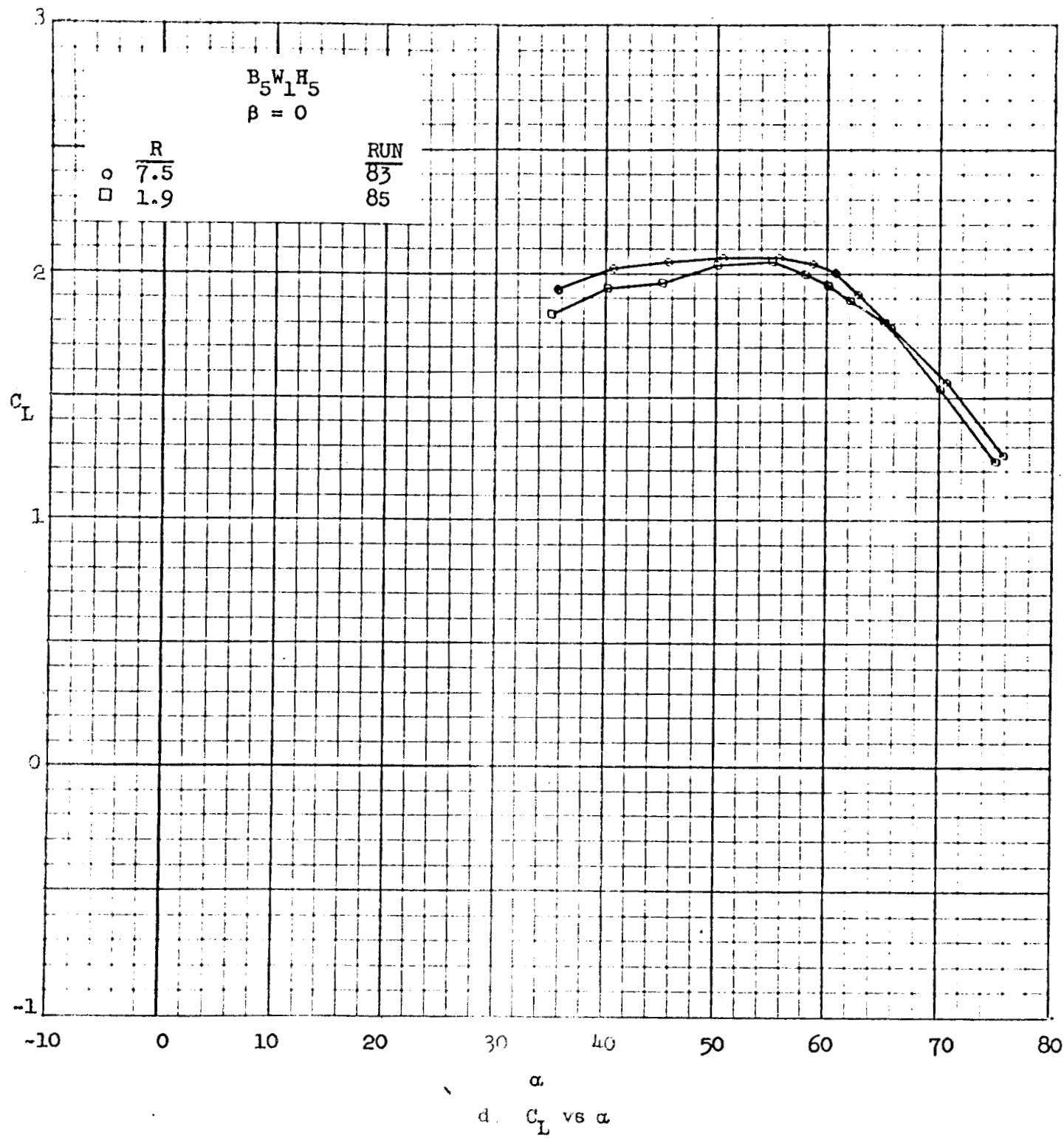


Figure 18. - Continued

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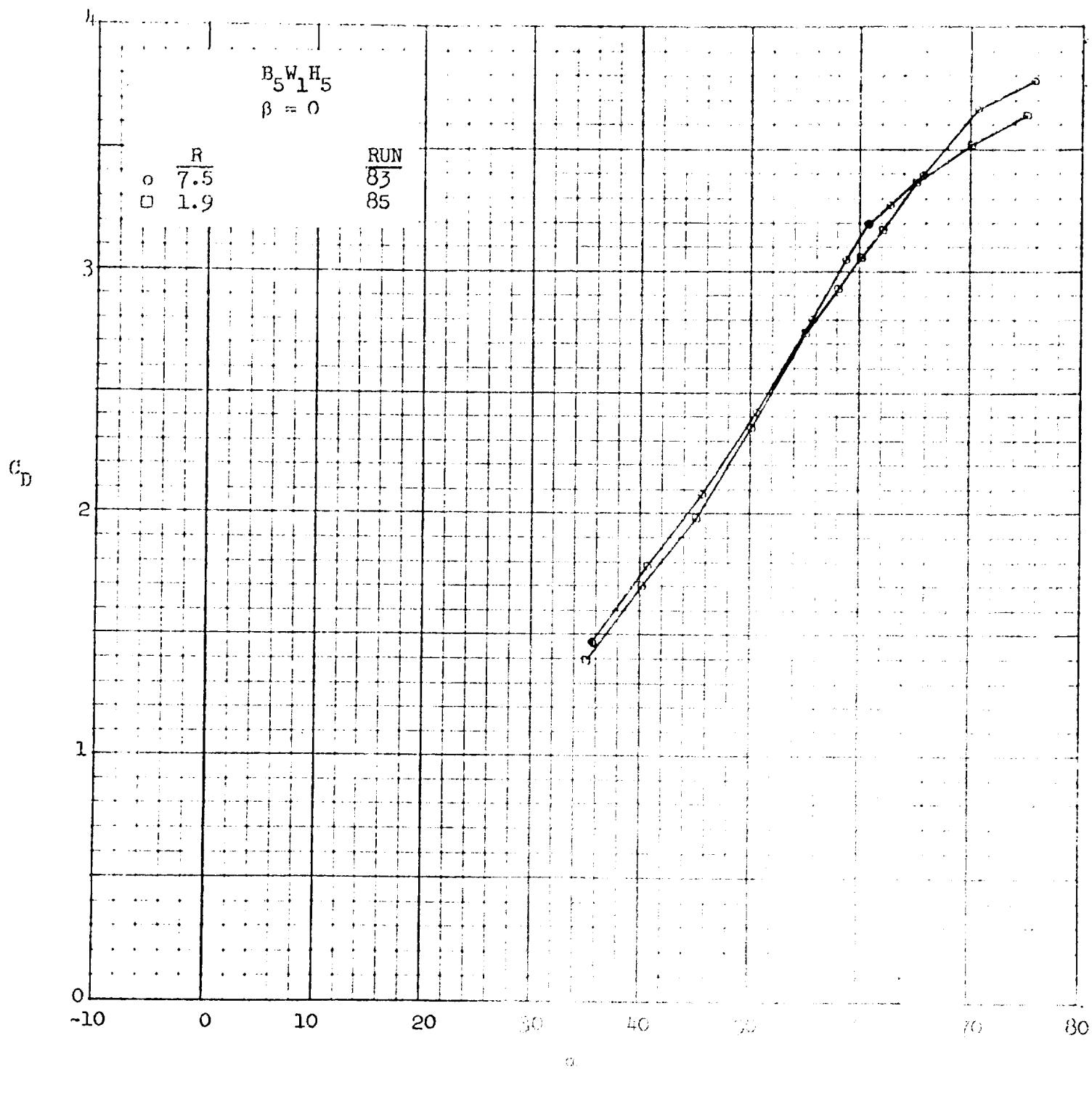


Figure 18. - continued

e. C_D vs α

National Aeronautics and Space Administration
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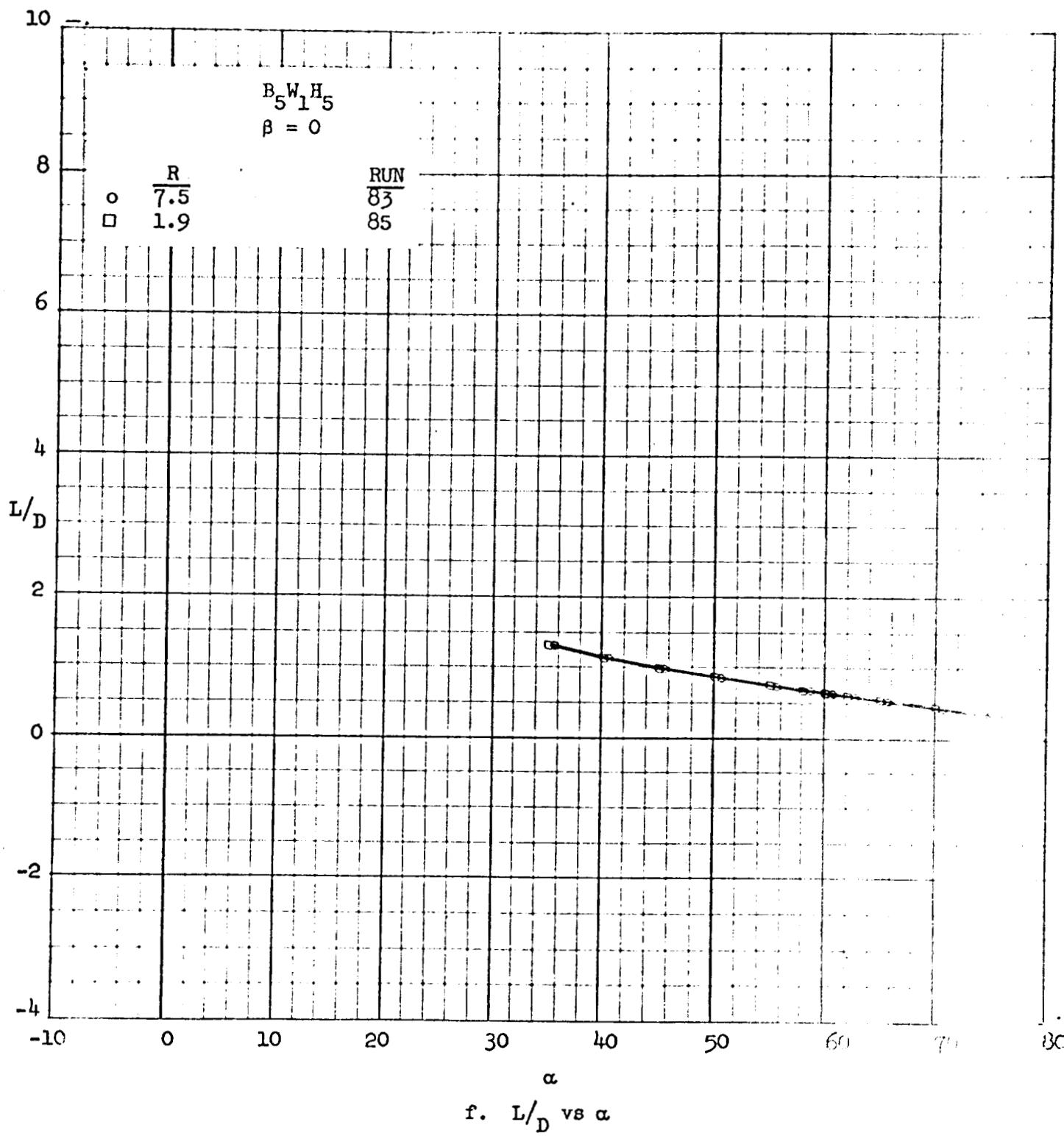
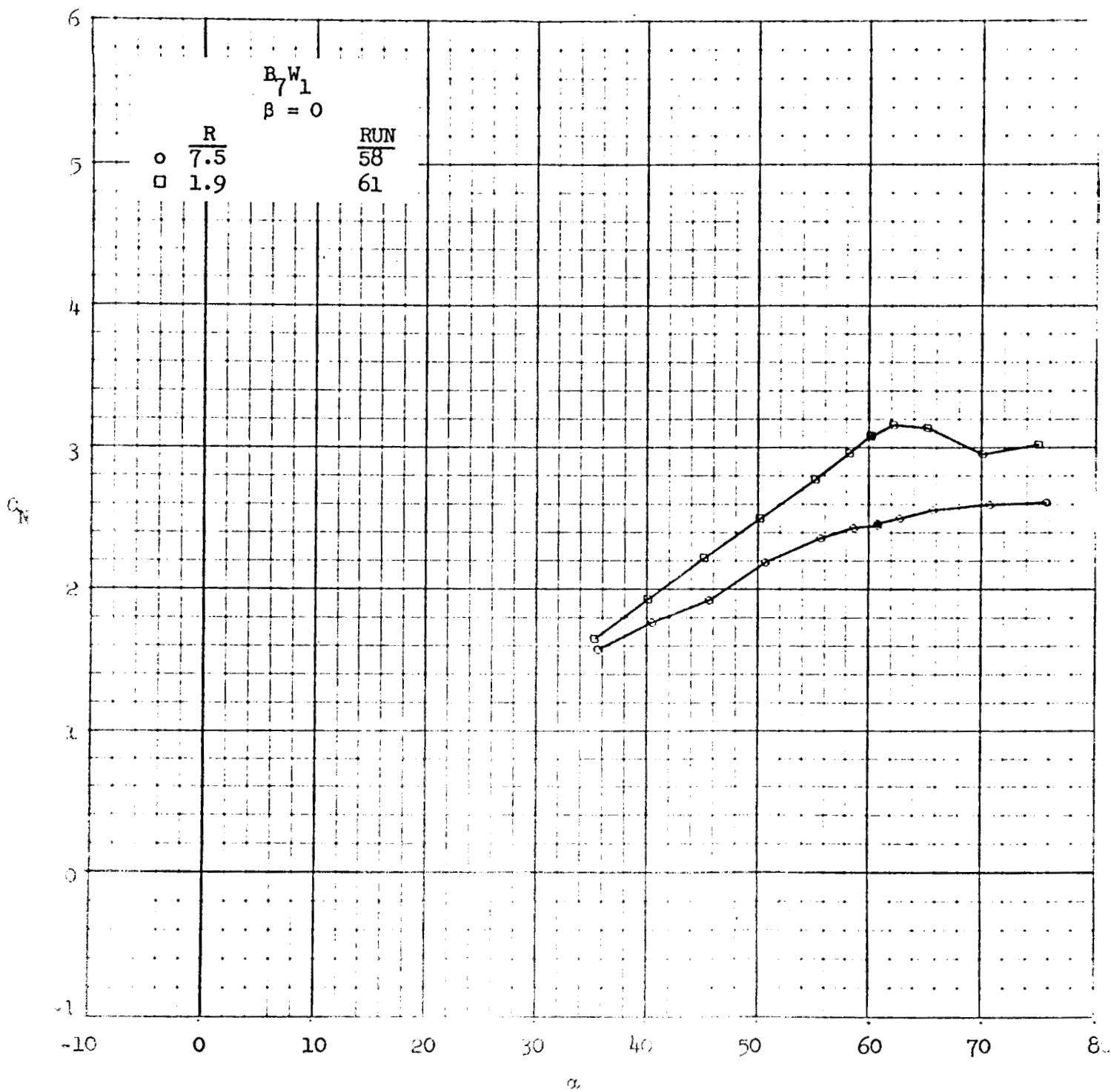


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National Aeronautics and Space Administration
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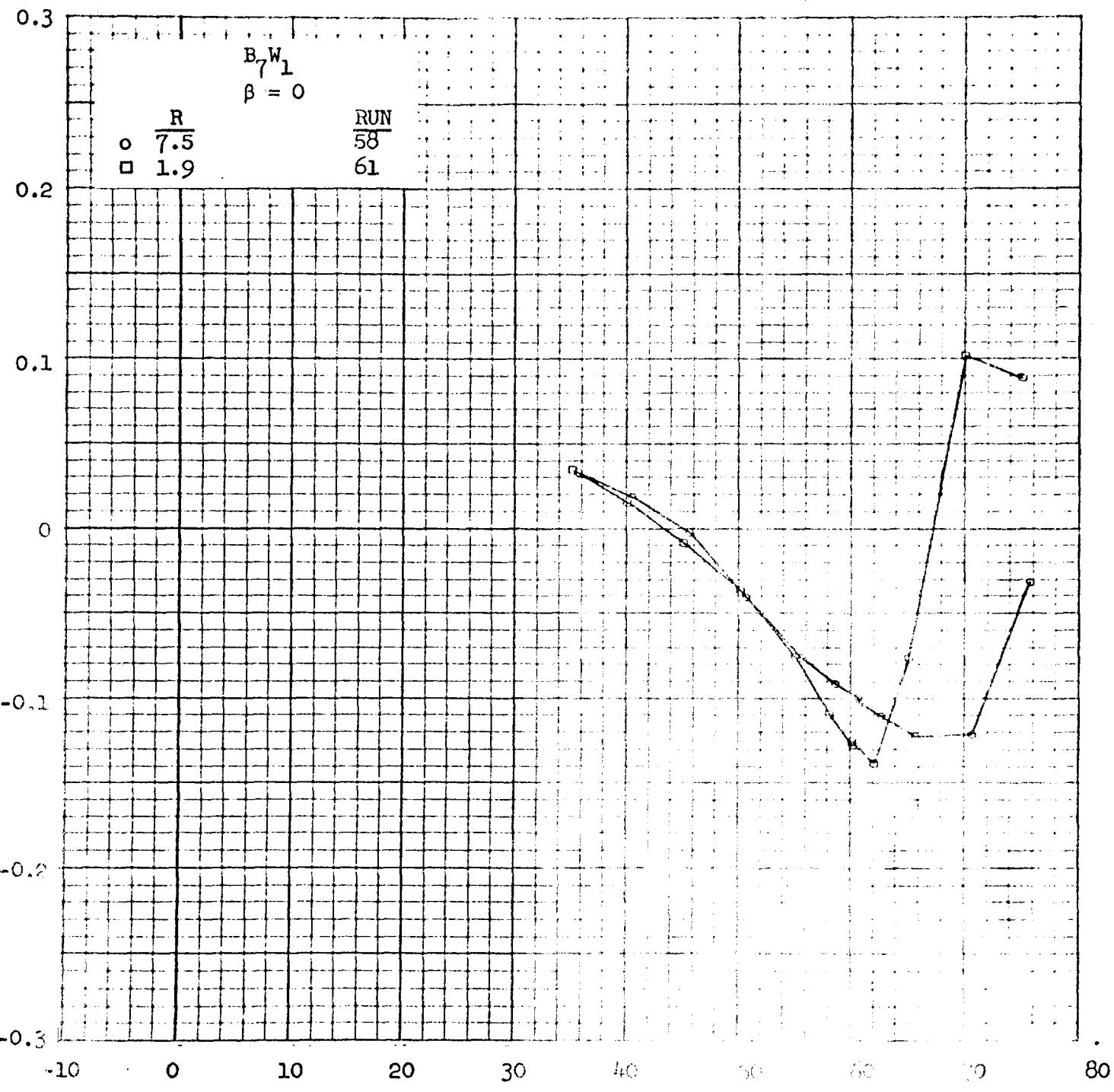


a. C_N vs α

Figure 19. - Effect of angle of attack on longitudinal characteristics at various Reynolds numbers for several model configurations, B_7W_1 .
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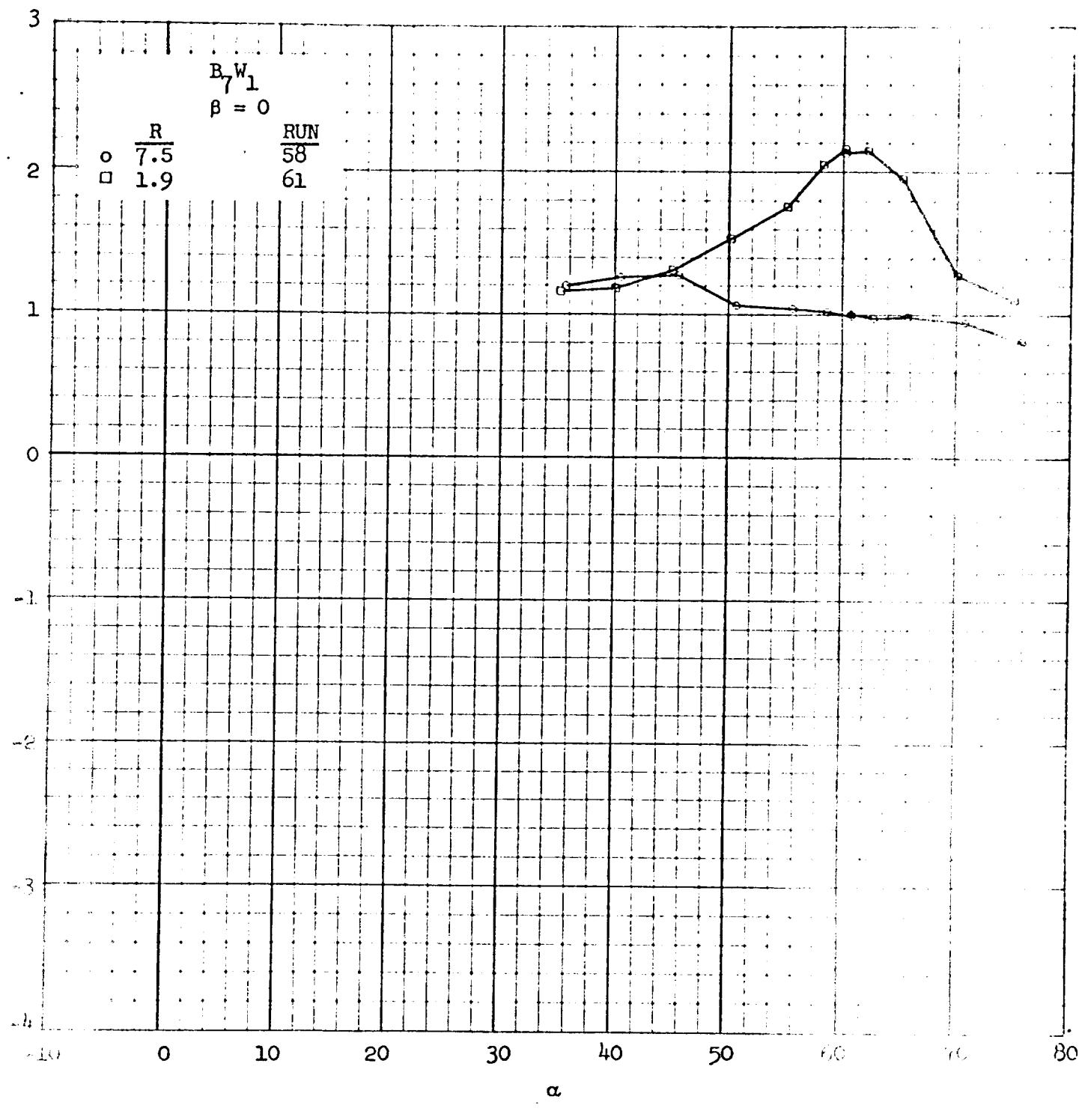


b. C_A vs α

Figure 19. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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c. C_m vs α

Figure 19. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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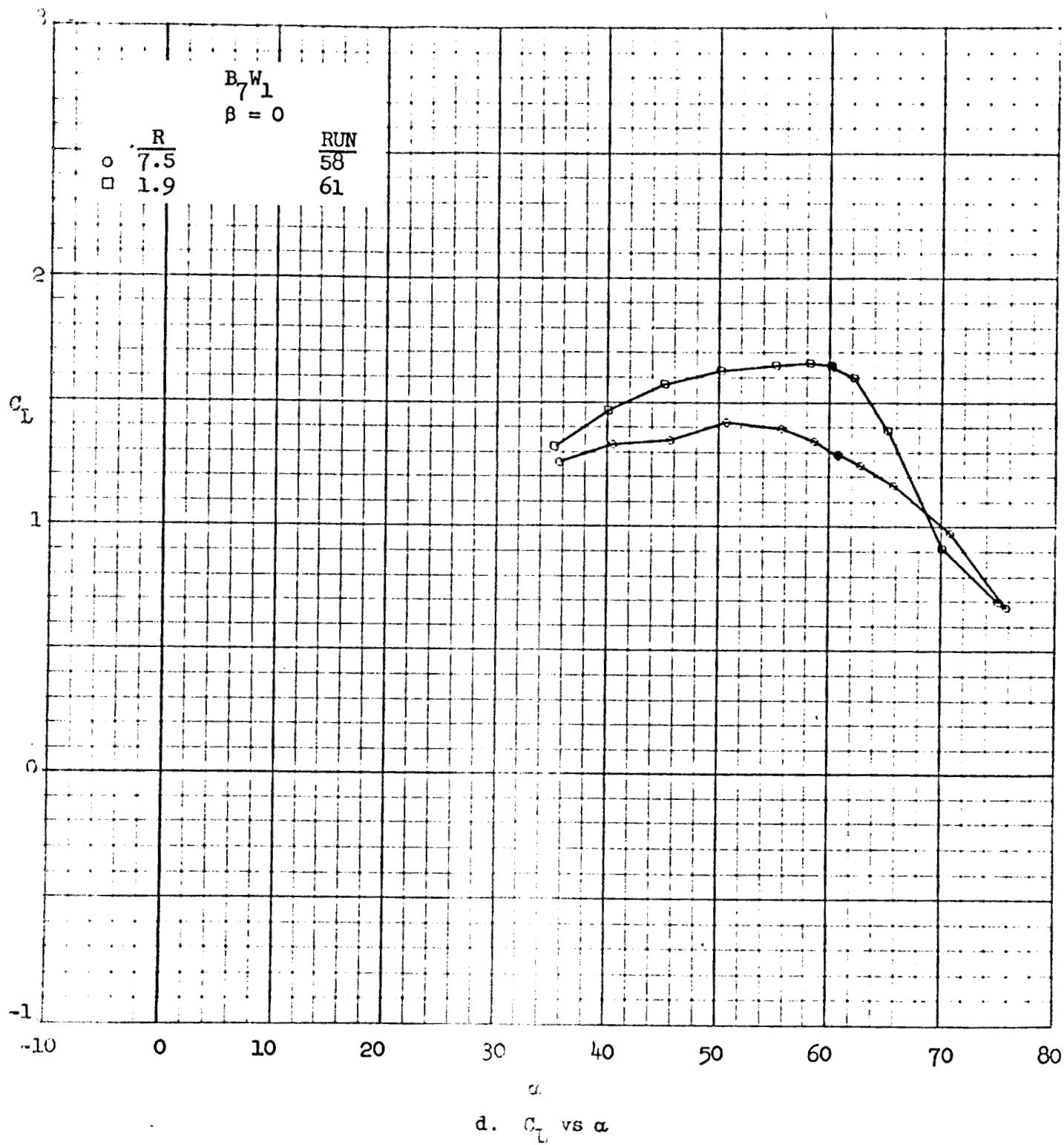


Figure 19. - Continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.
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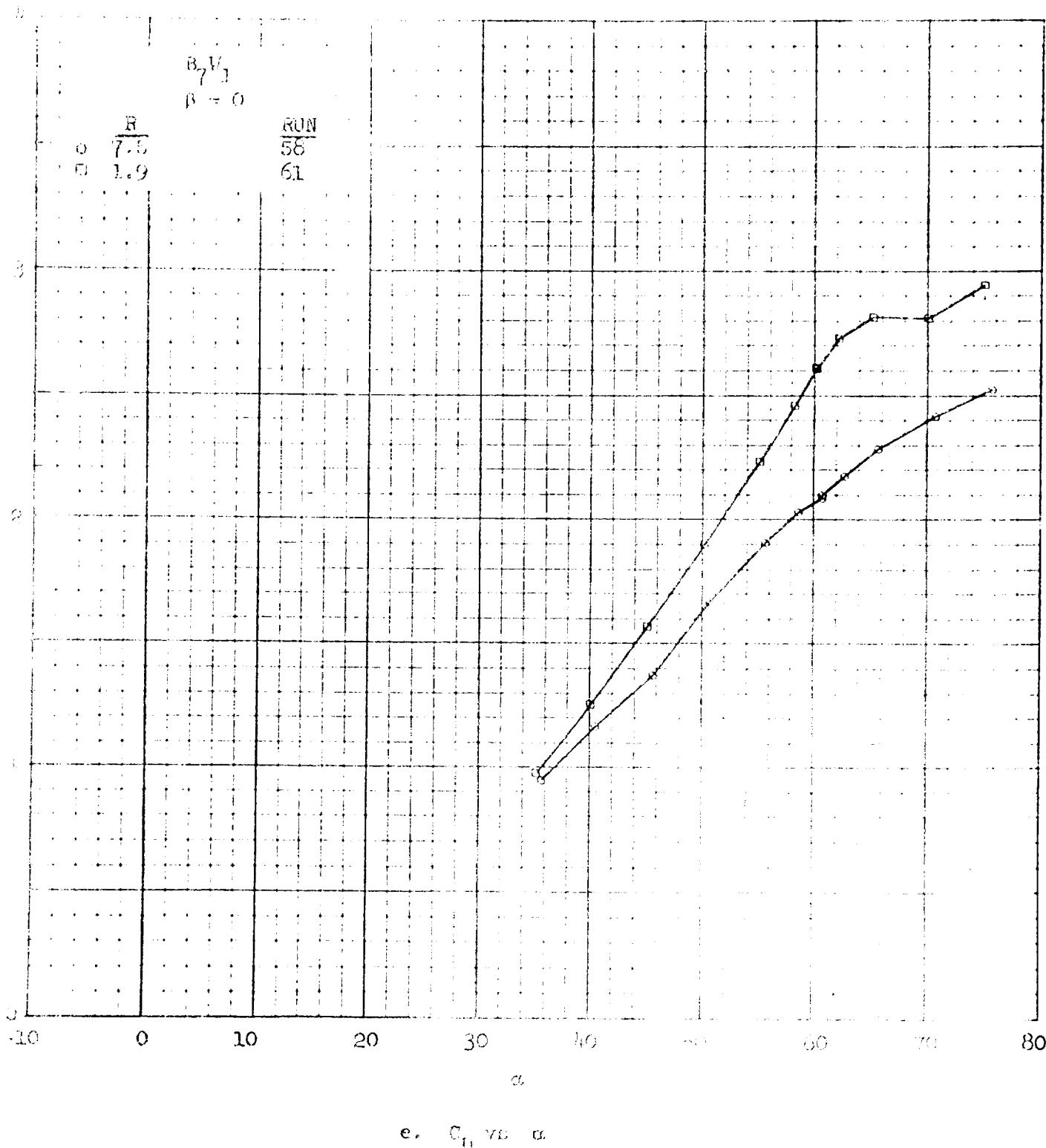


Figure 19. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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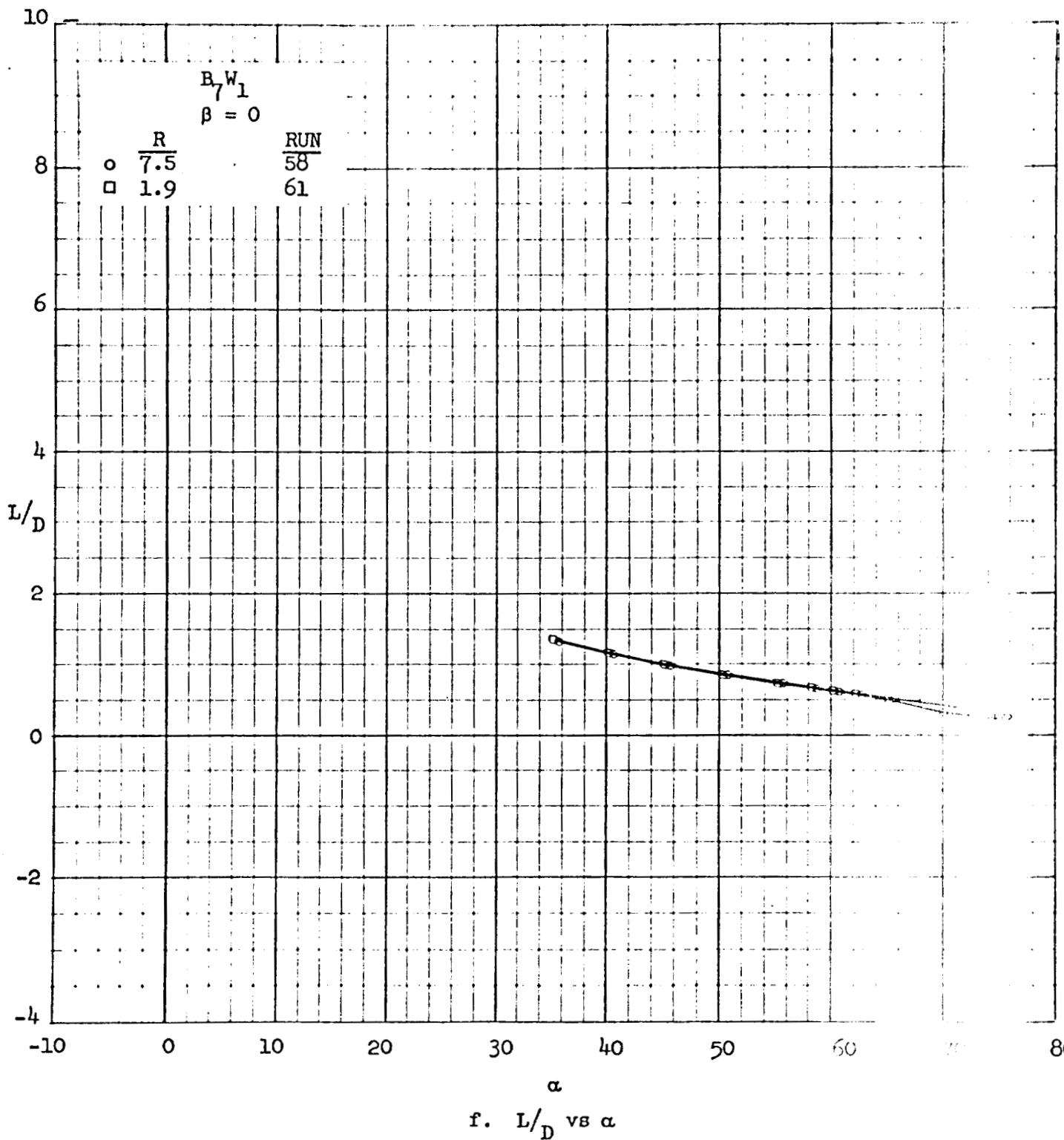
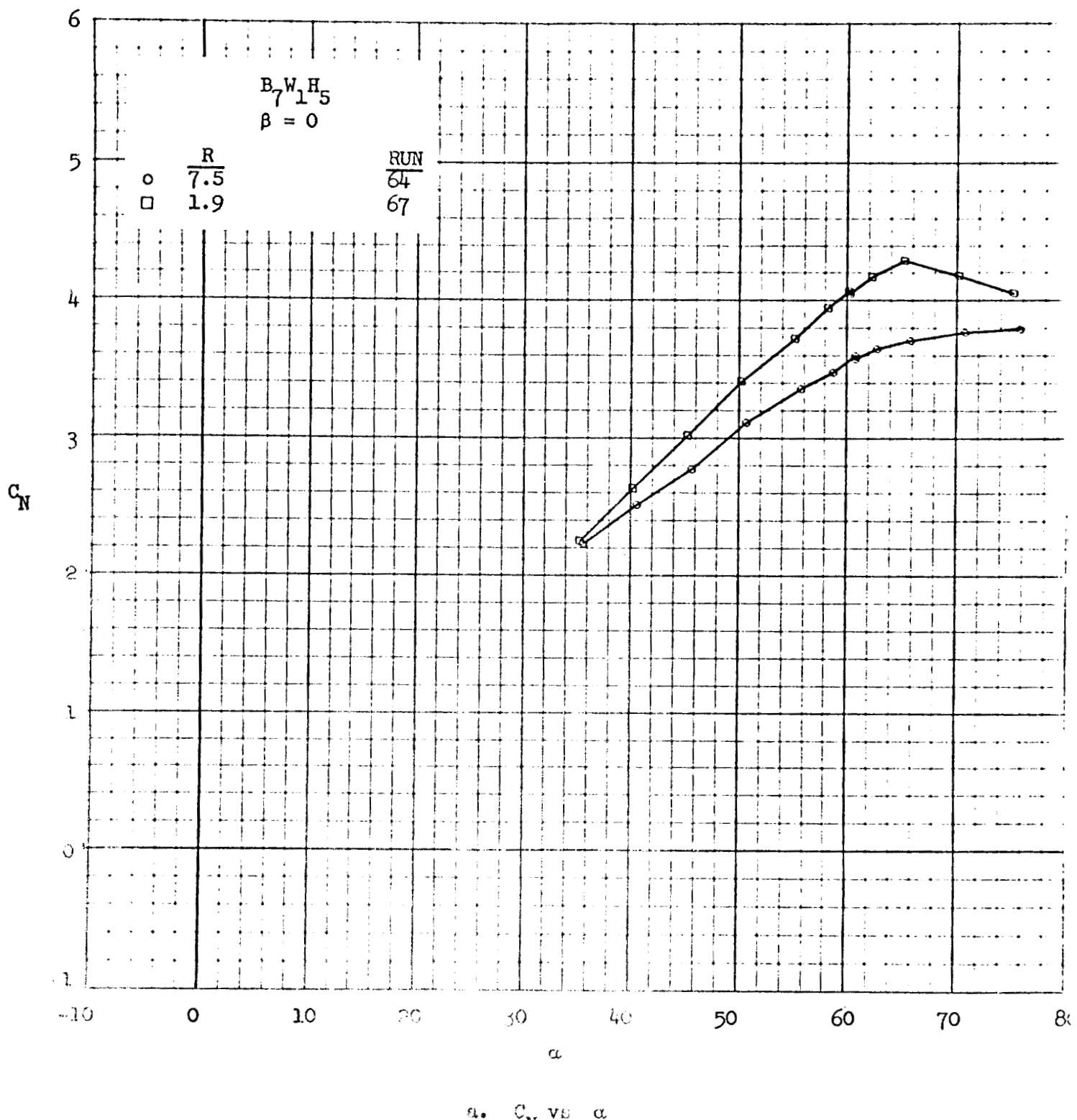


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Ames Research Center: MOFFETT FIELD, CALIF.

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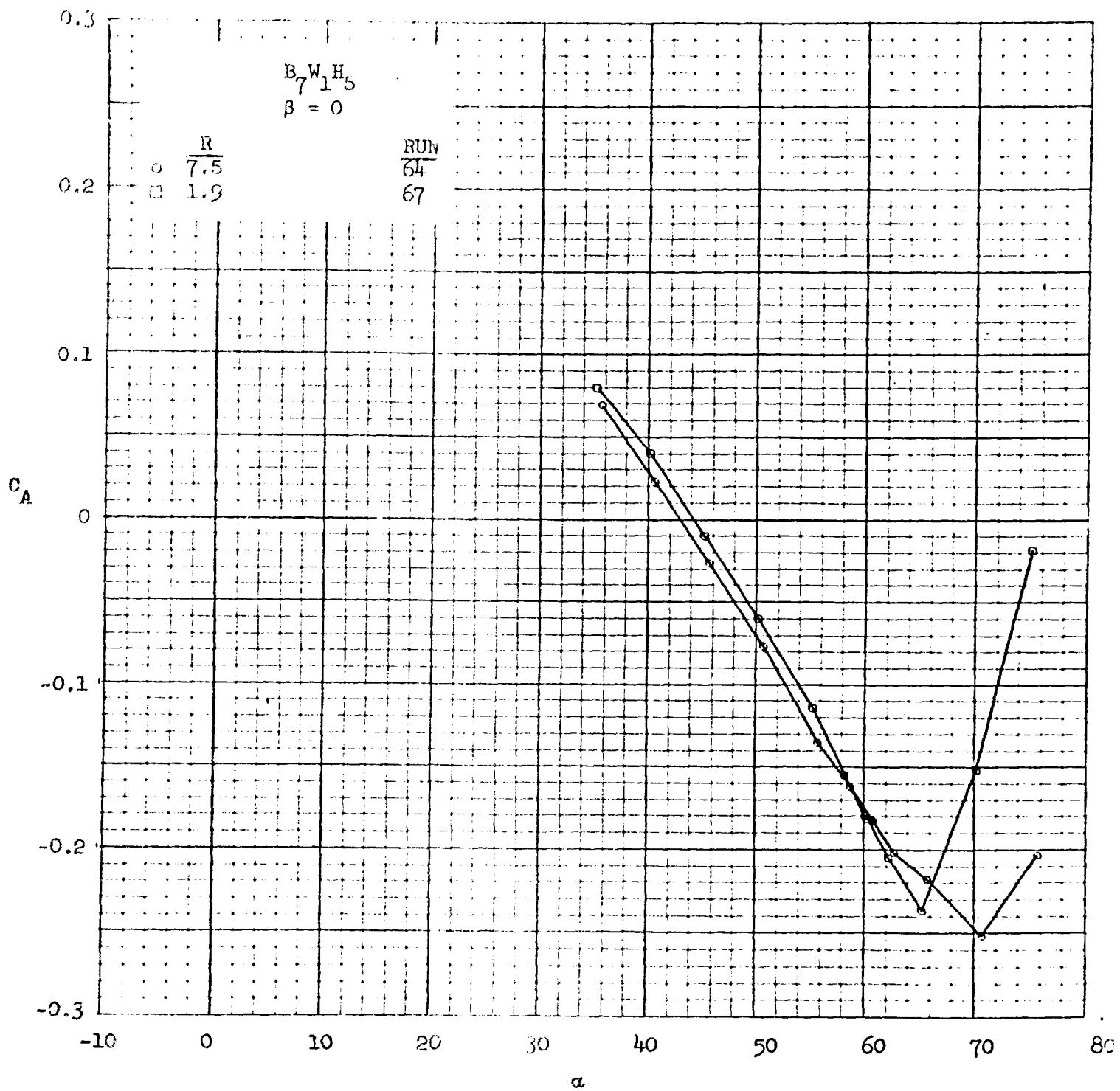


a. C_N vs α

Figure 20. - Effect of angle of attack on longitudinal characteristics at various Reynolds numbers for several model configurations, $B_7W_1H_5$.

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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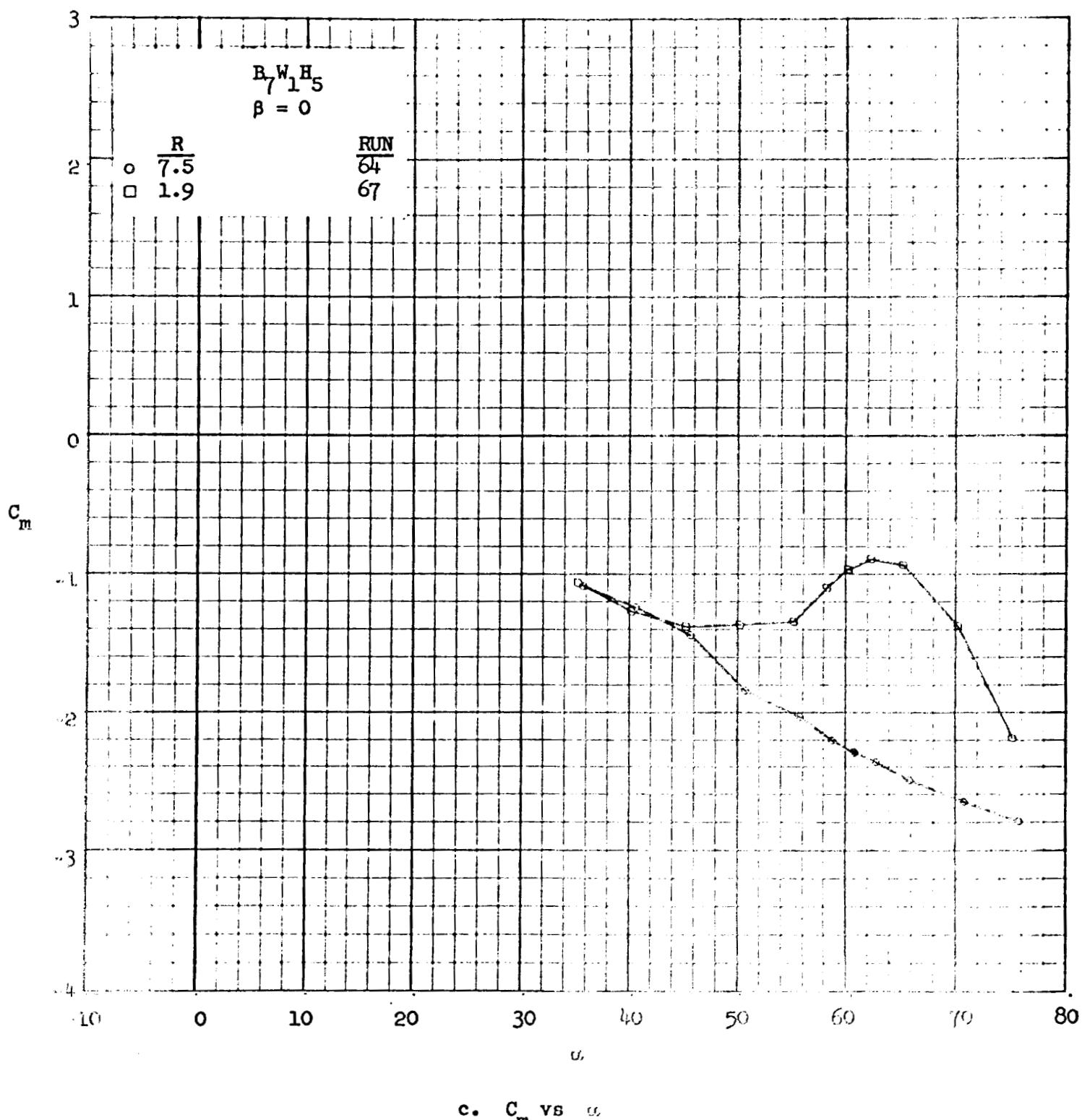


b. C_A vs α

Figure 20. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



c. C_m vs α

Figure 20. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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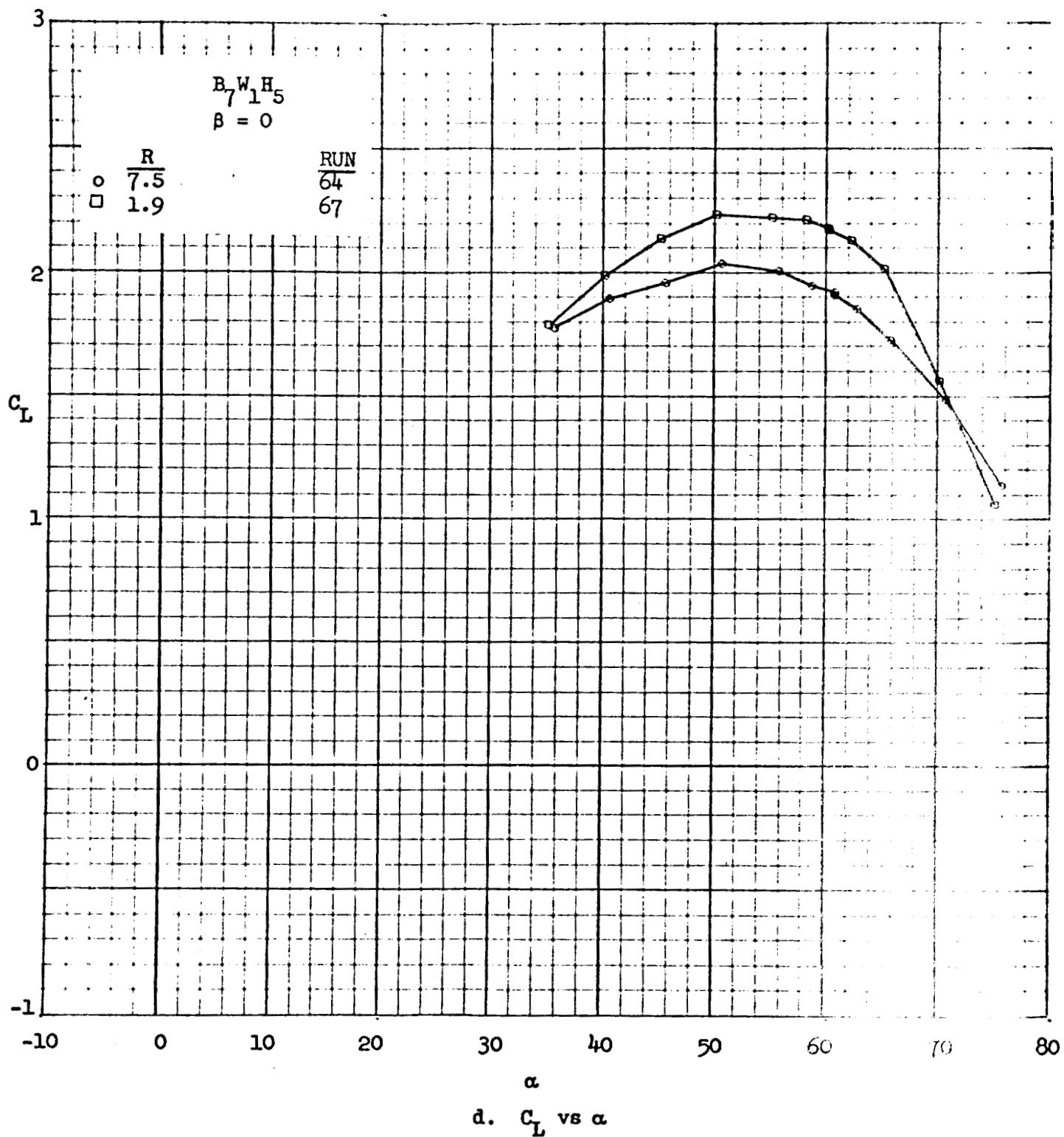
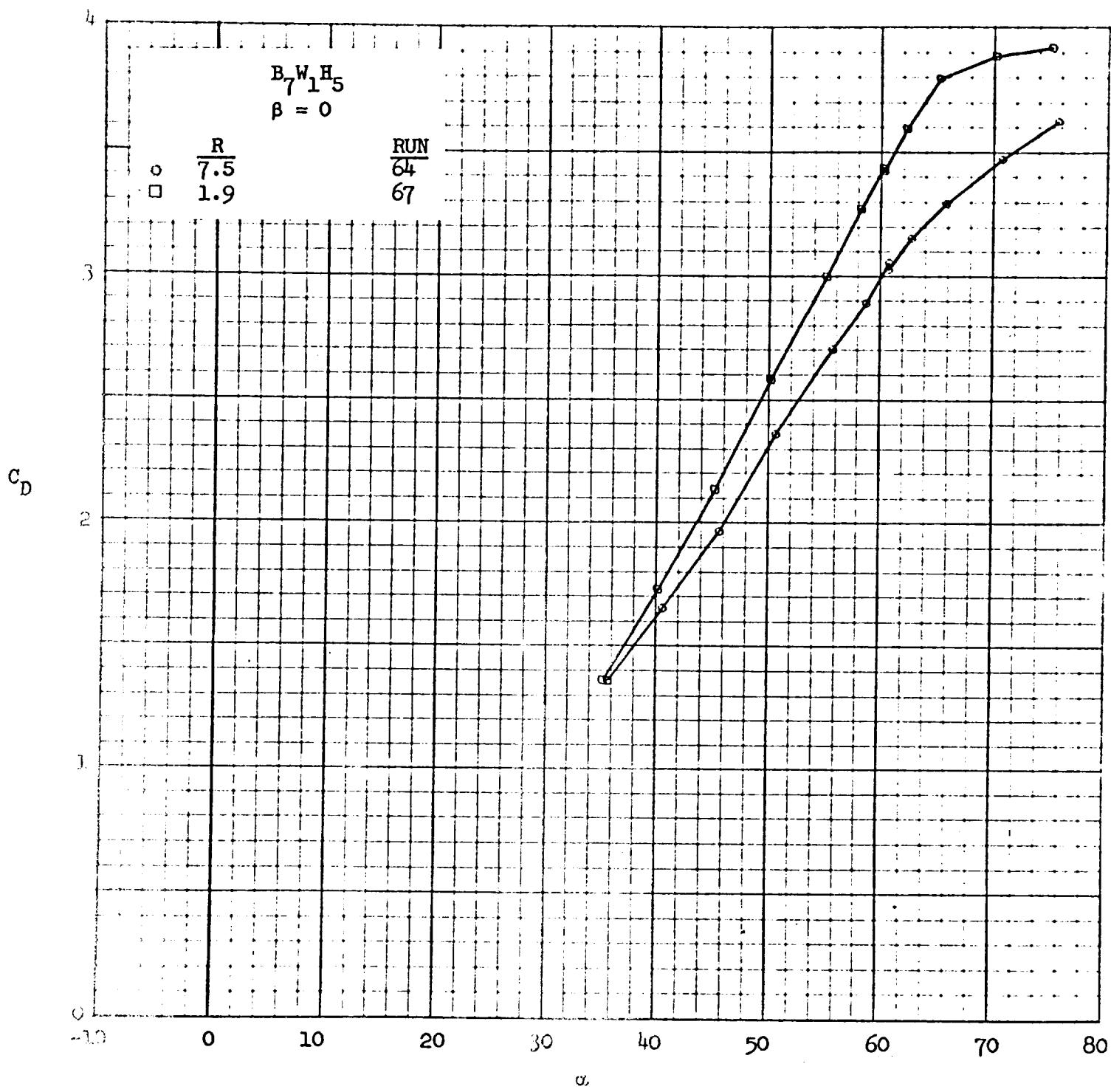


Figure 20. - Continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



e. C_D vs α

Figure 20. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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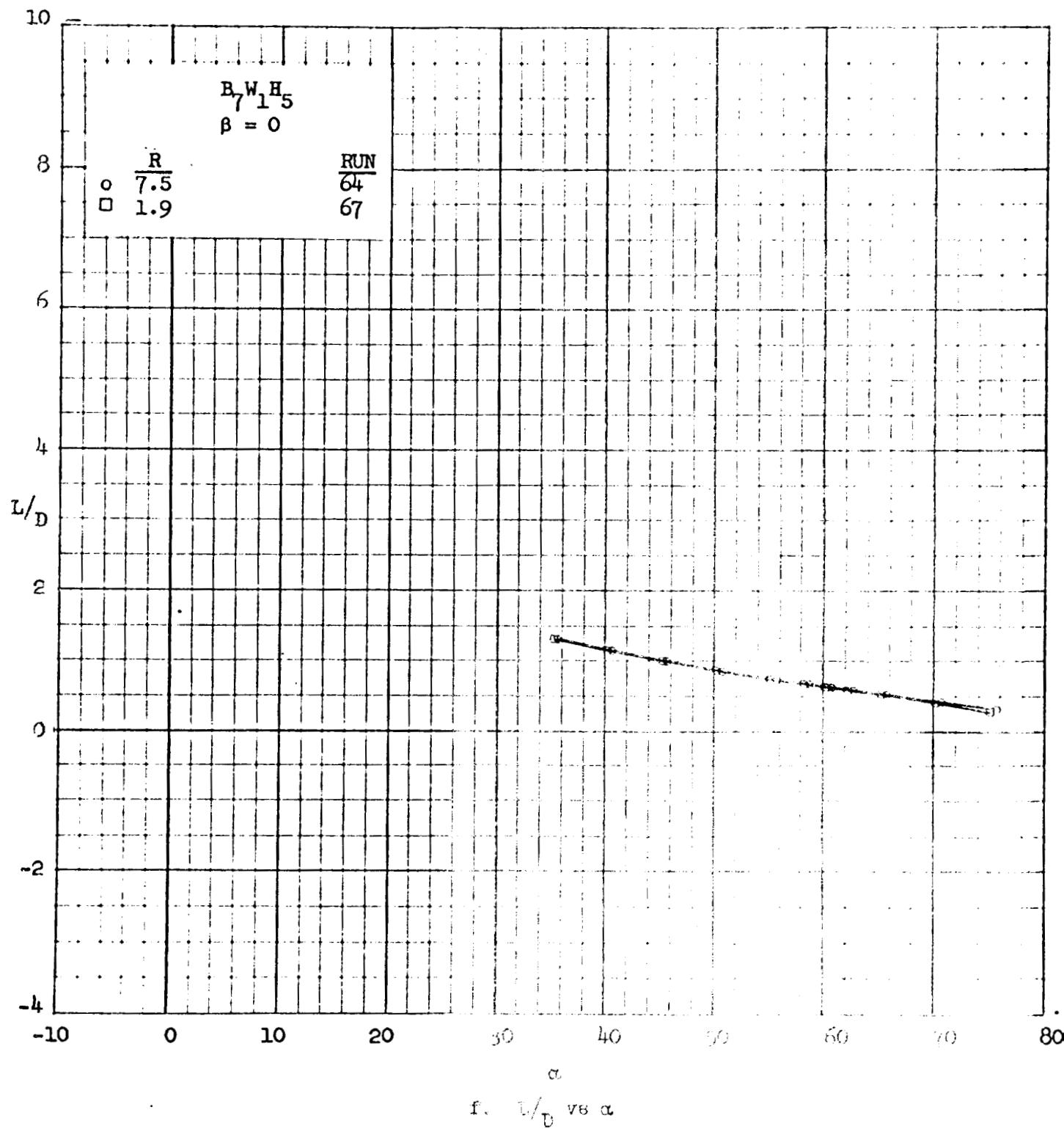
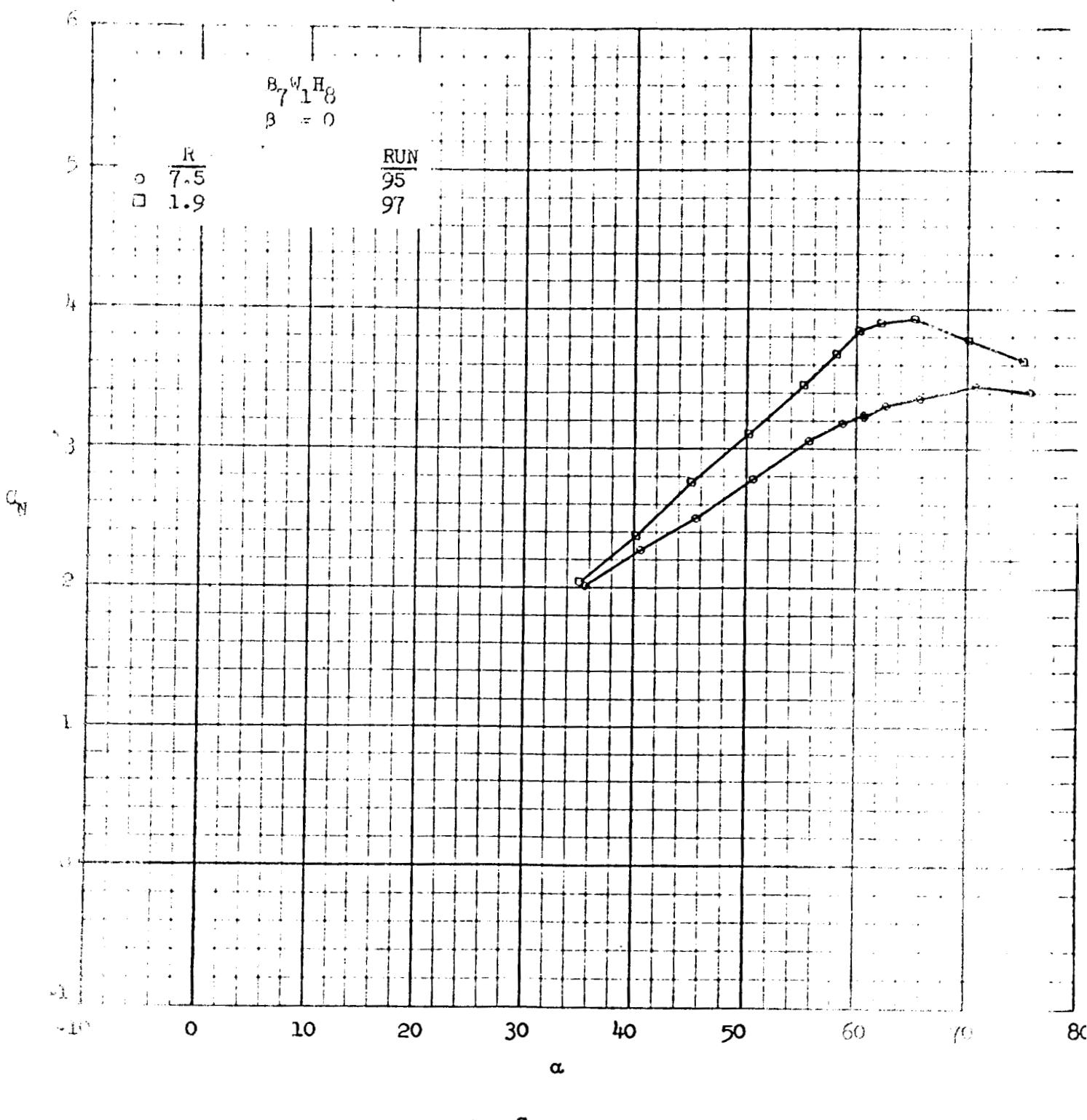


Figure 20 . - Concluded

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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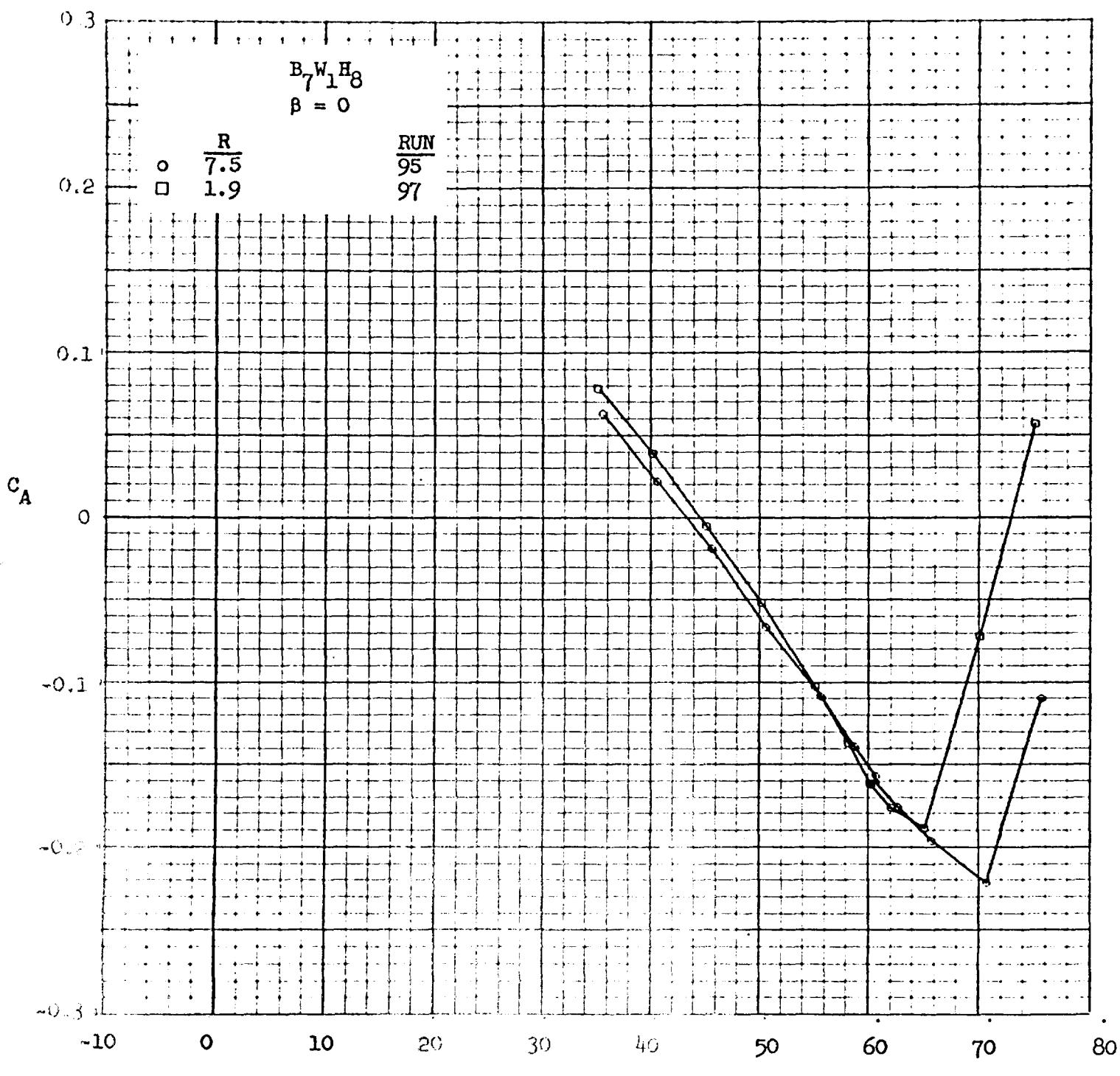


a. C_N vs α

Figure 21. - Effect of angle of attack on longitudinal characteristics at various Reynolds numbers for several model configurations, B_7W_{18} .

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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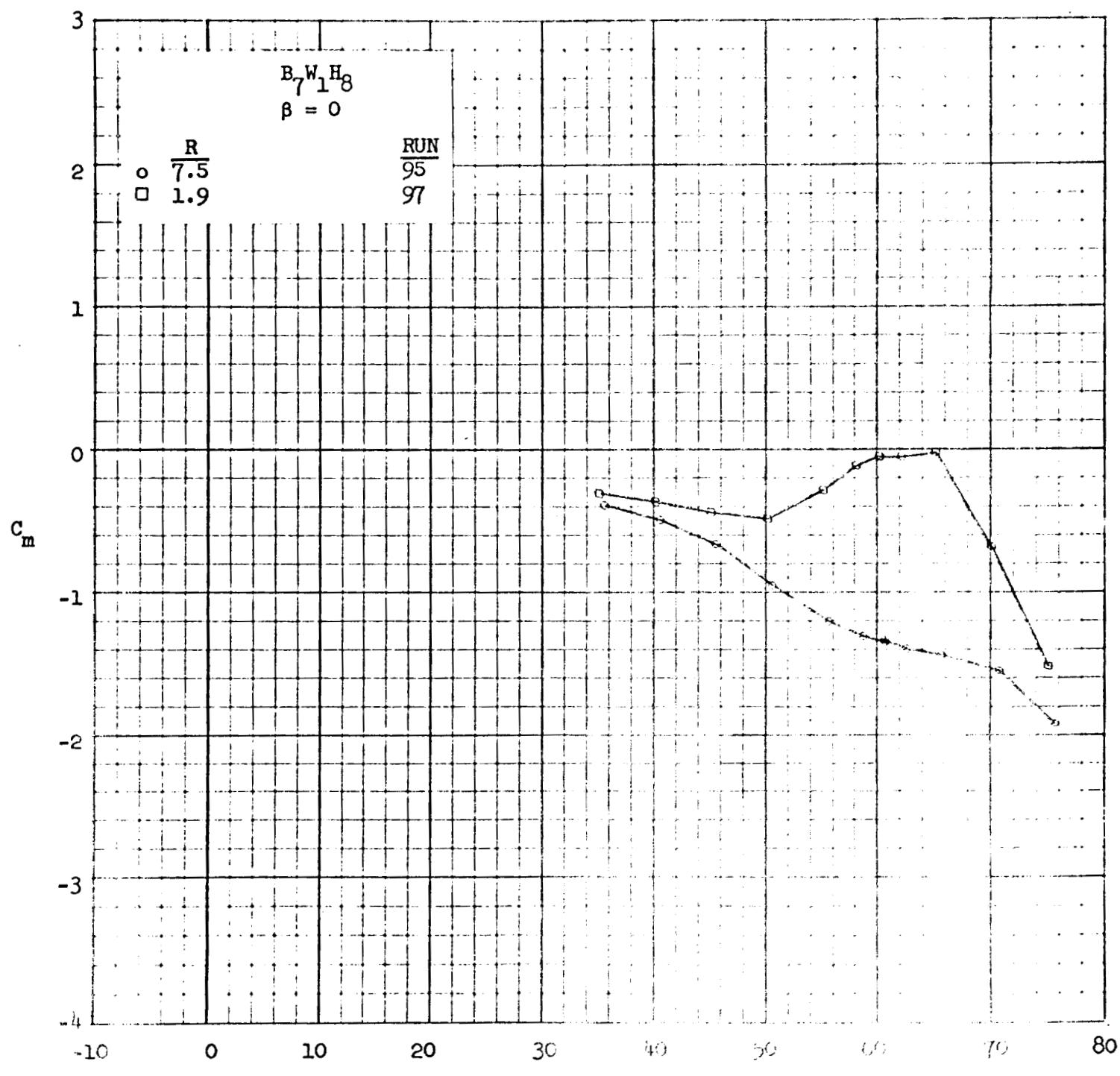


b. C_A vs. α

Figure 21. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



c. C_m vs α

Figure 21. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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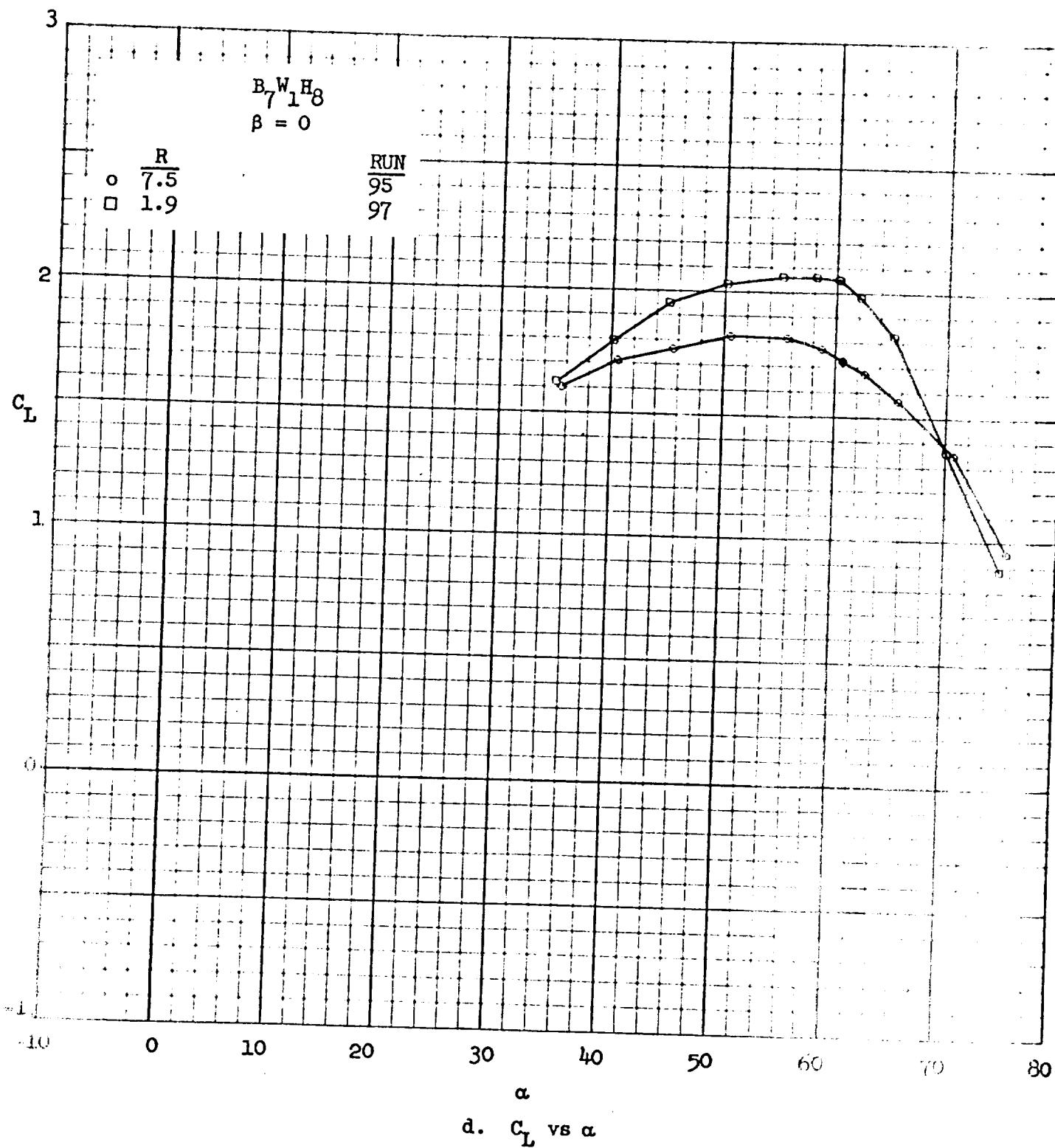


Figure 21. - Continued

C-2

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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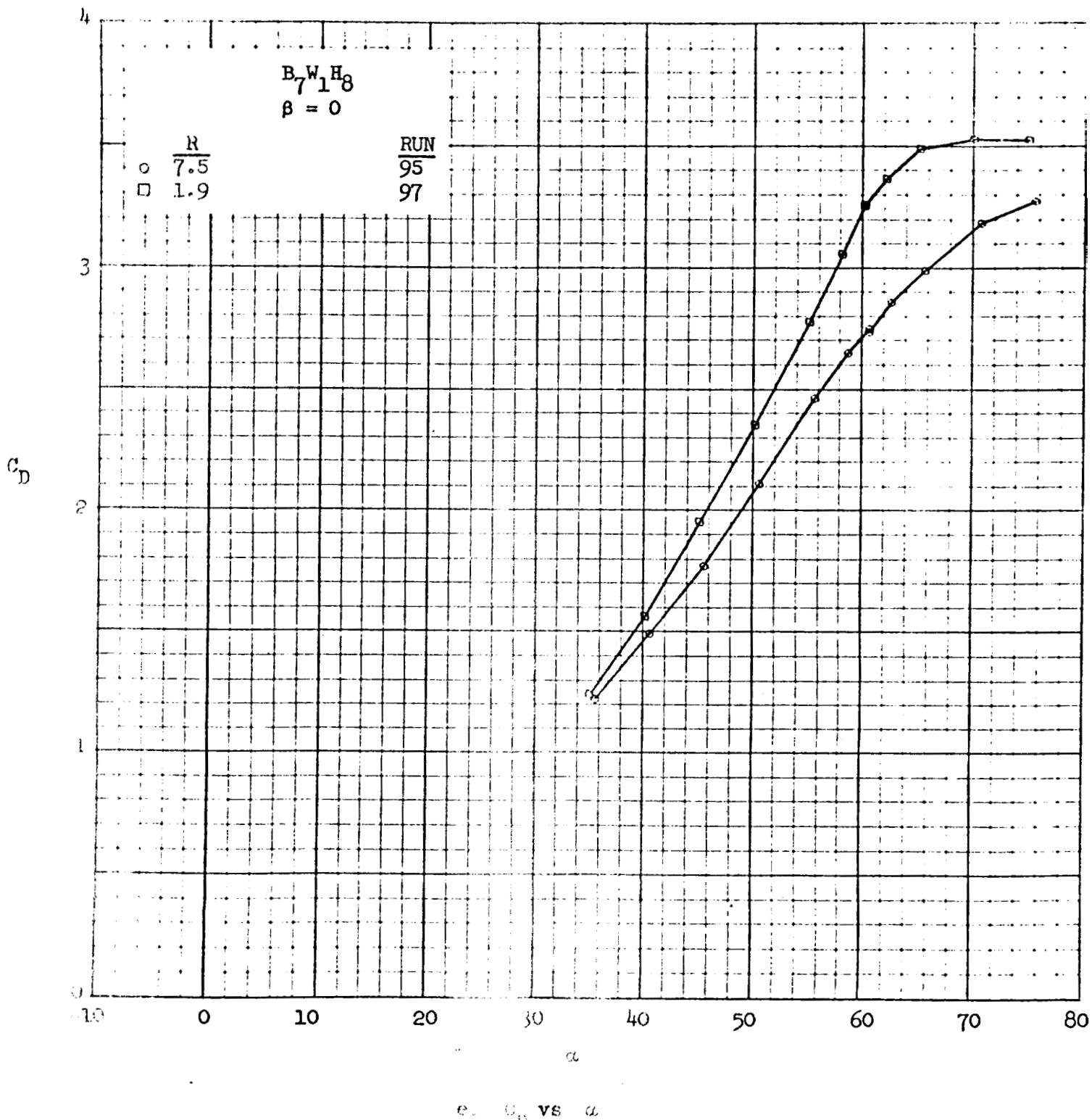


Figure 21. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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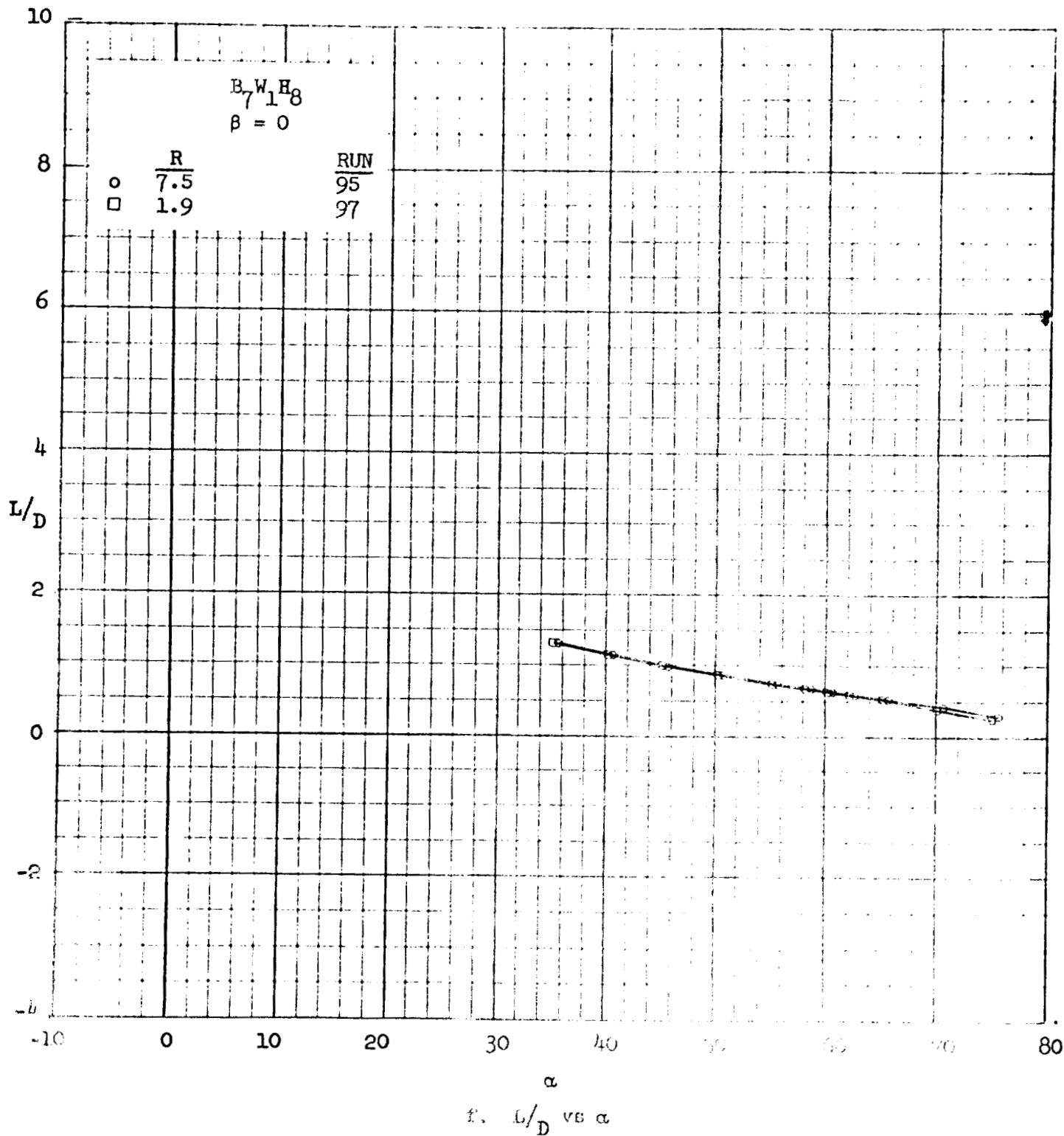
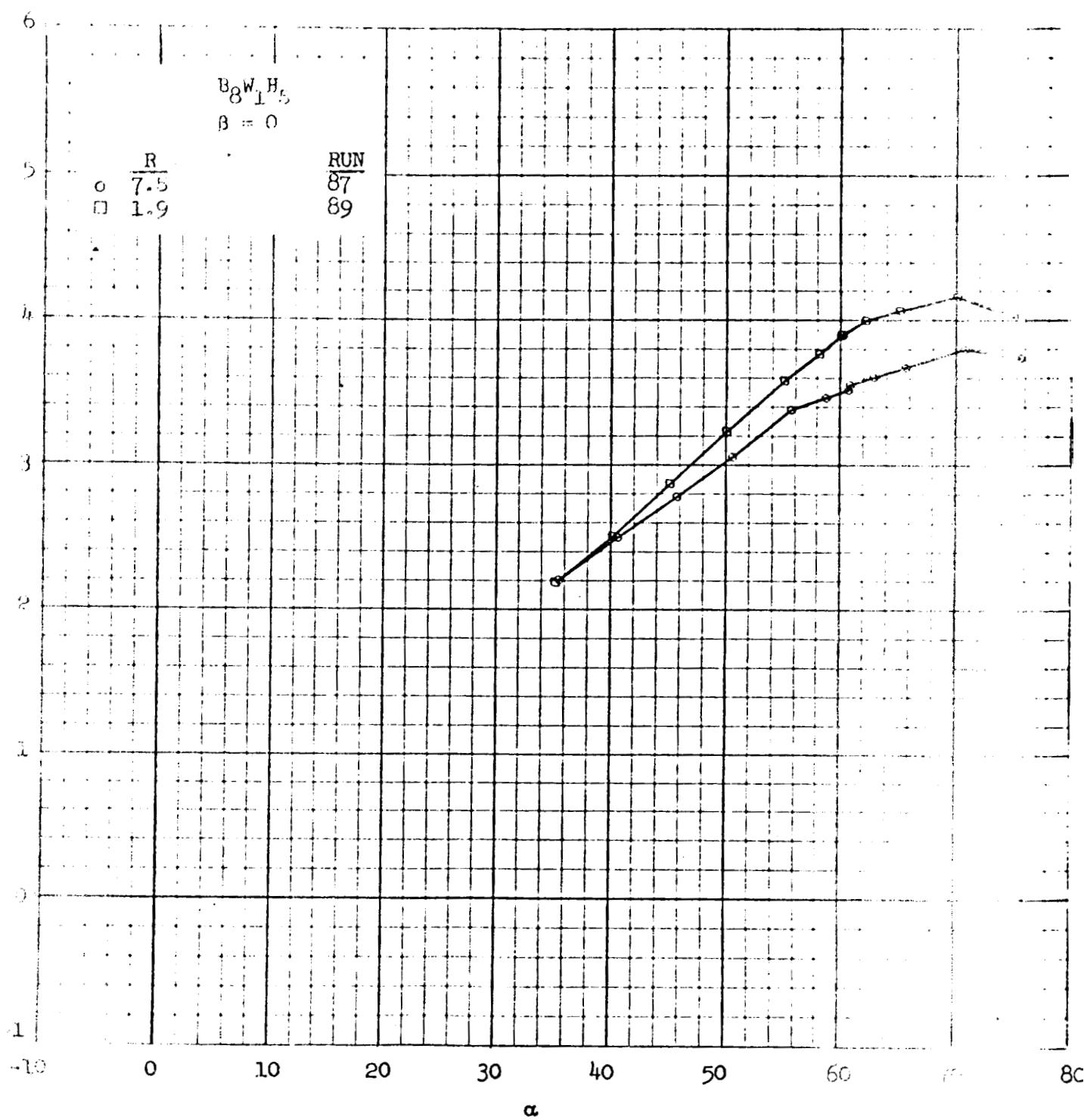


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National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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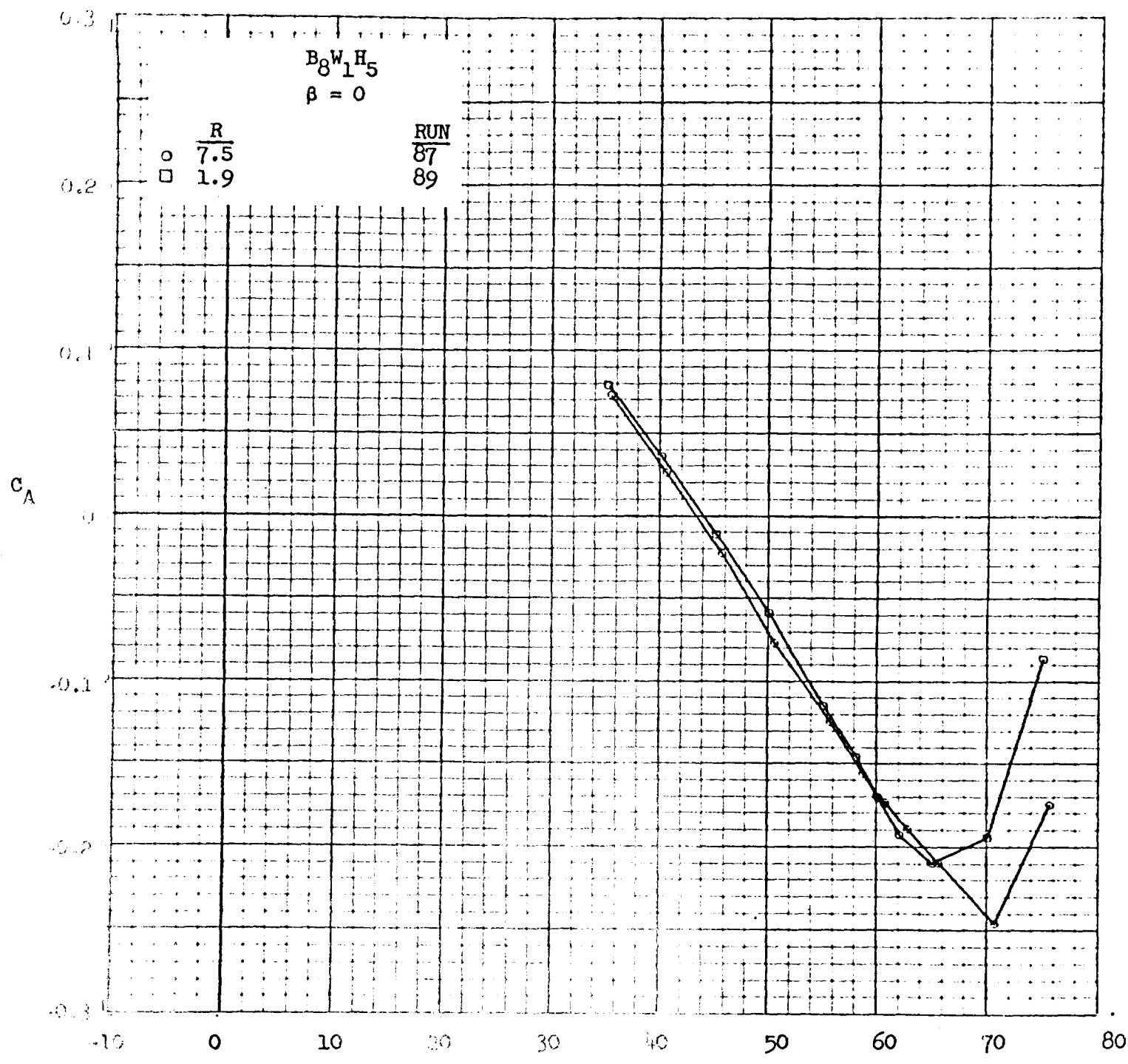


a. C_N vs α

Figure 22. - Effect of angle of attack on longitudinal characteristics for various Reynolds numbers for several model configurations.

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



b. C_A vs α

Figure 22. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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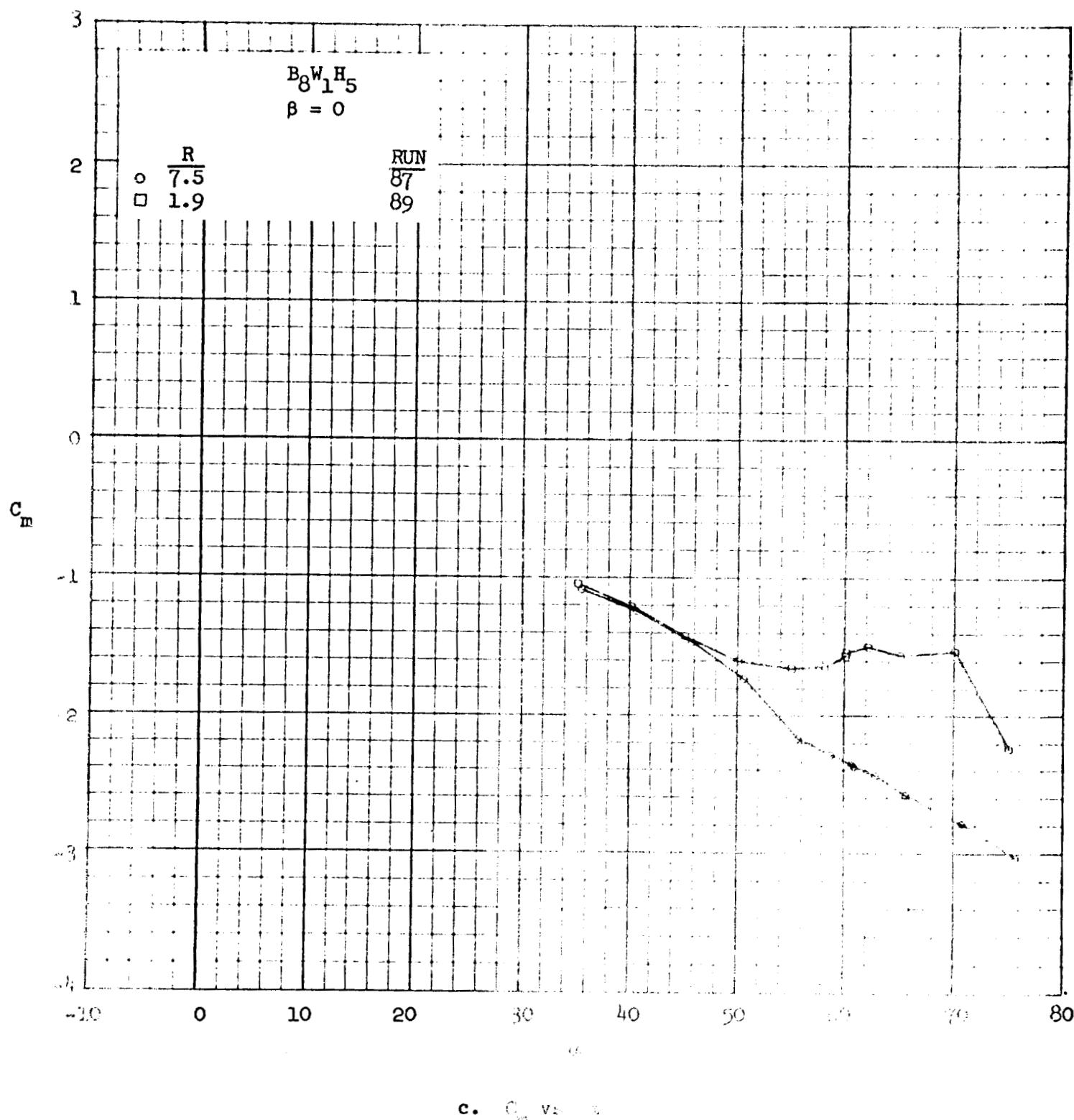


Figure 22. - continued

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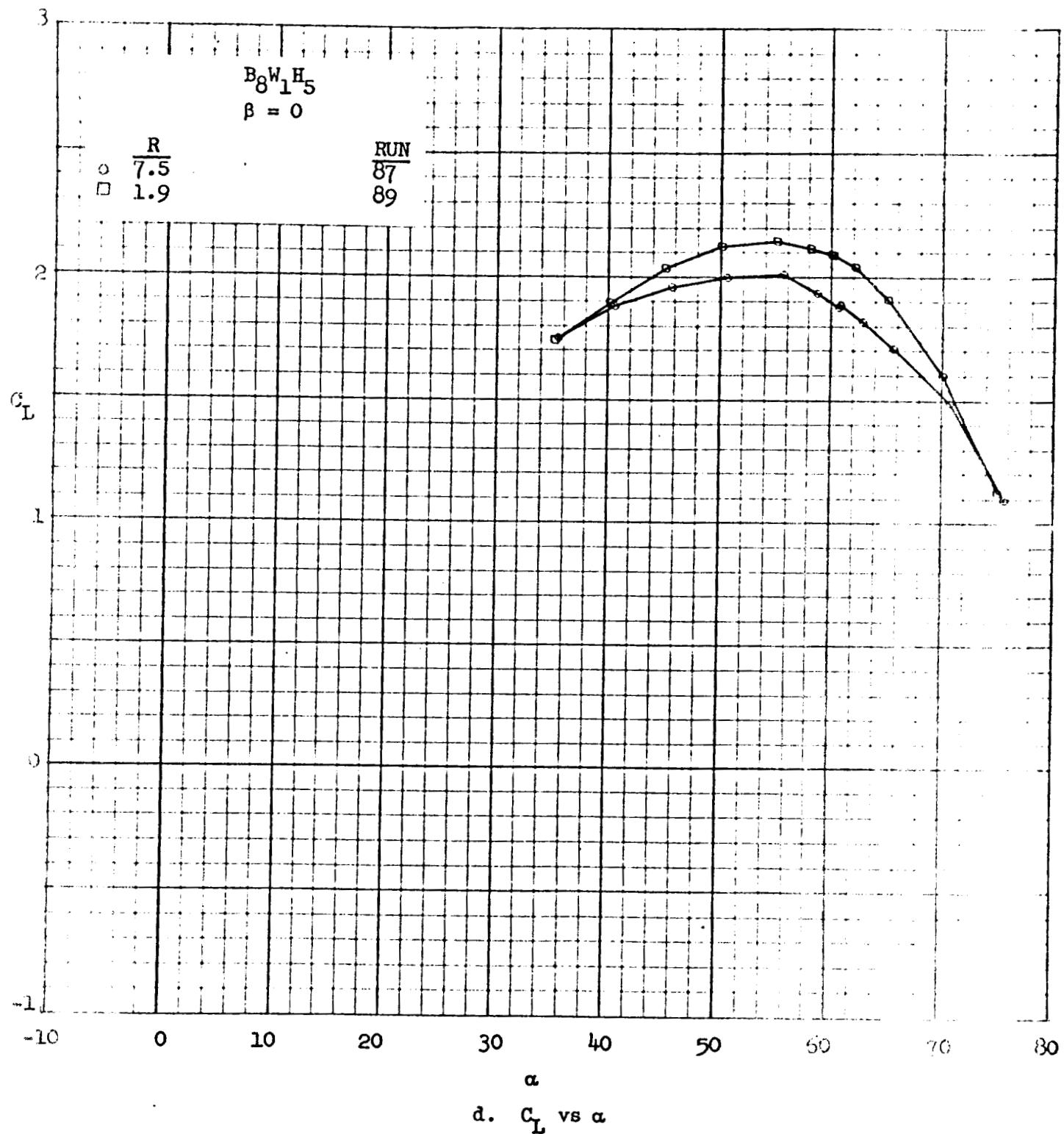
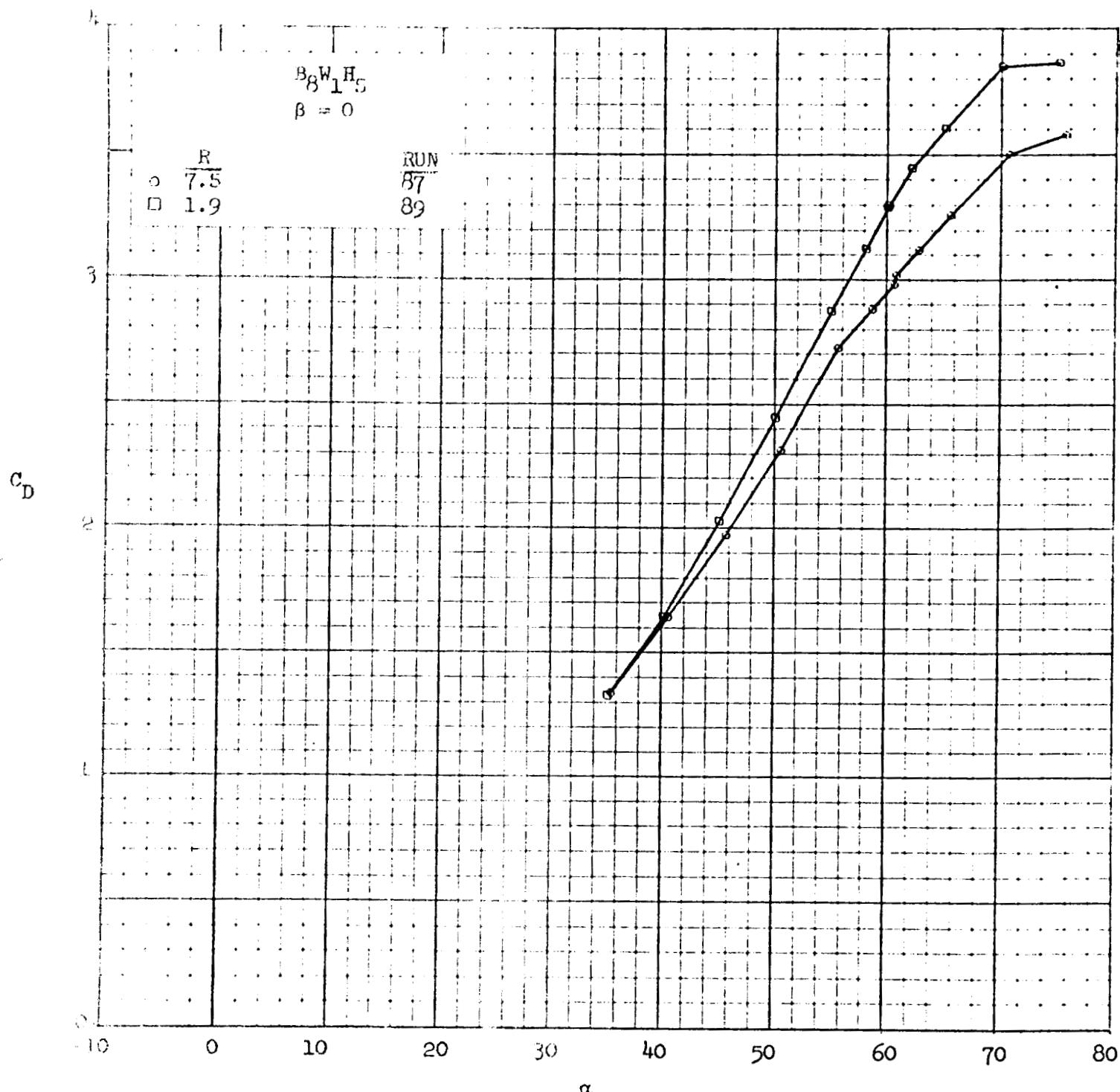


Figure 22. - Continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



e. C_D vs α

Figure 22. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA

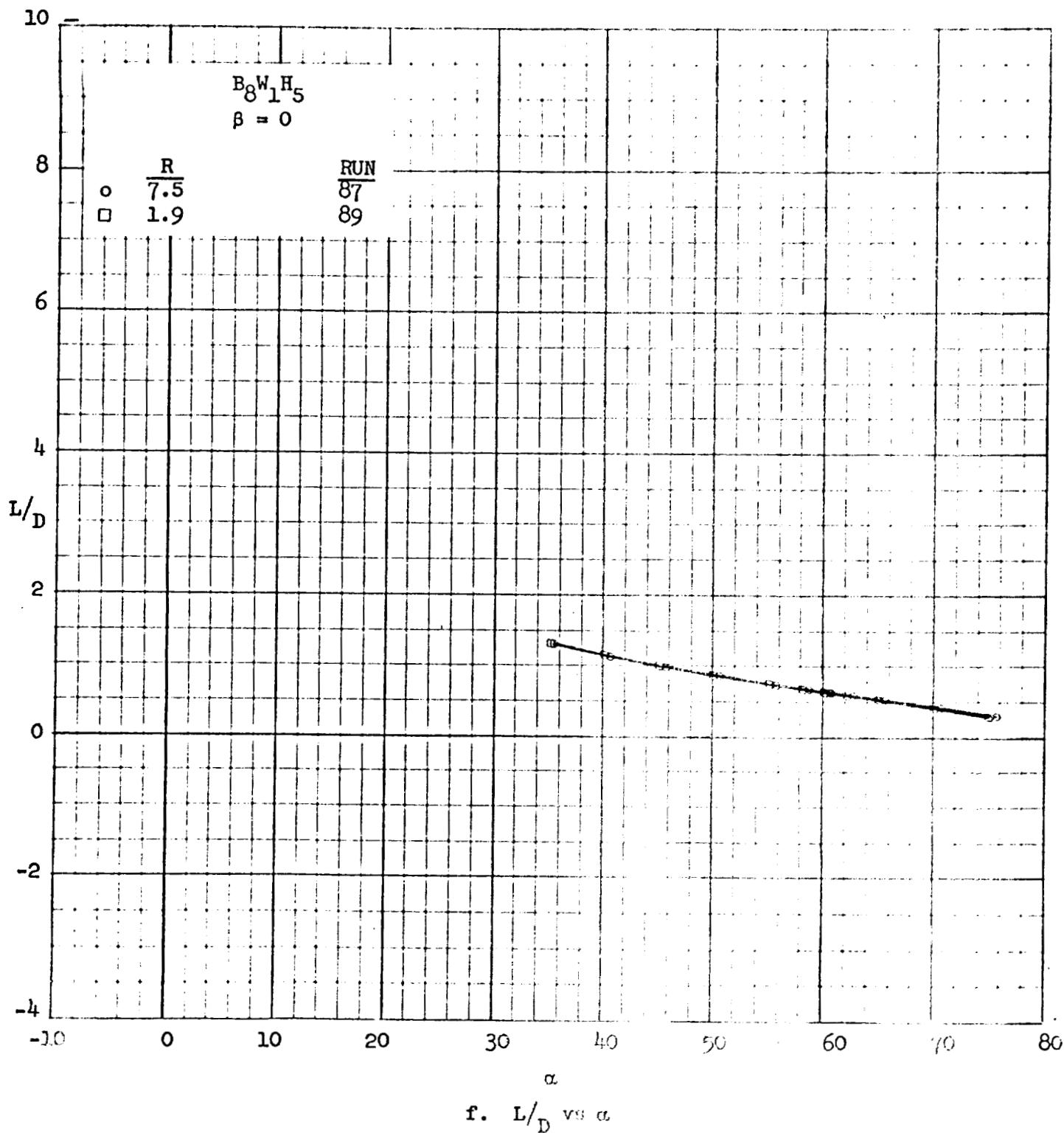


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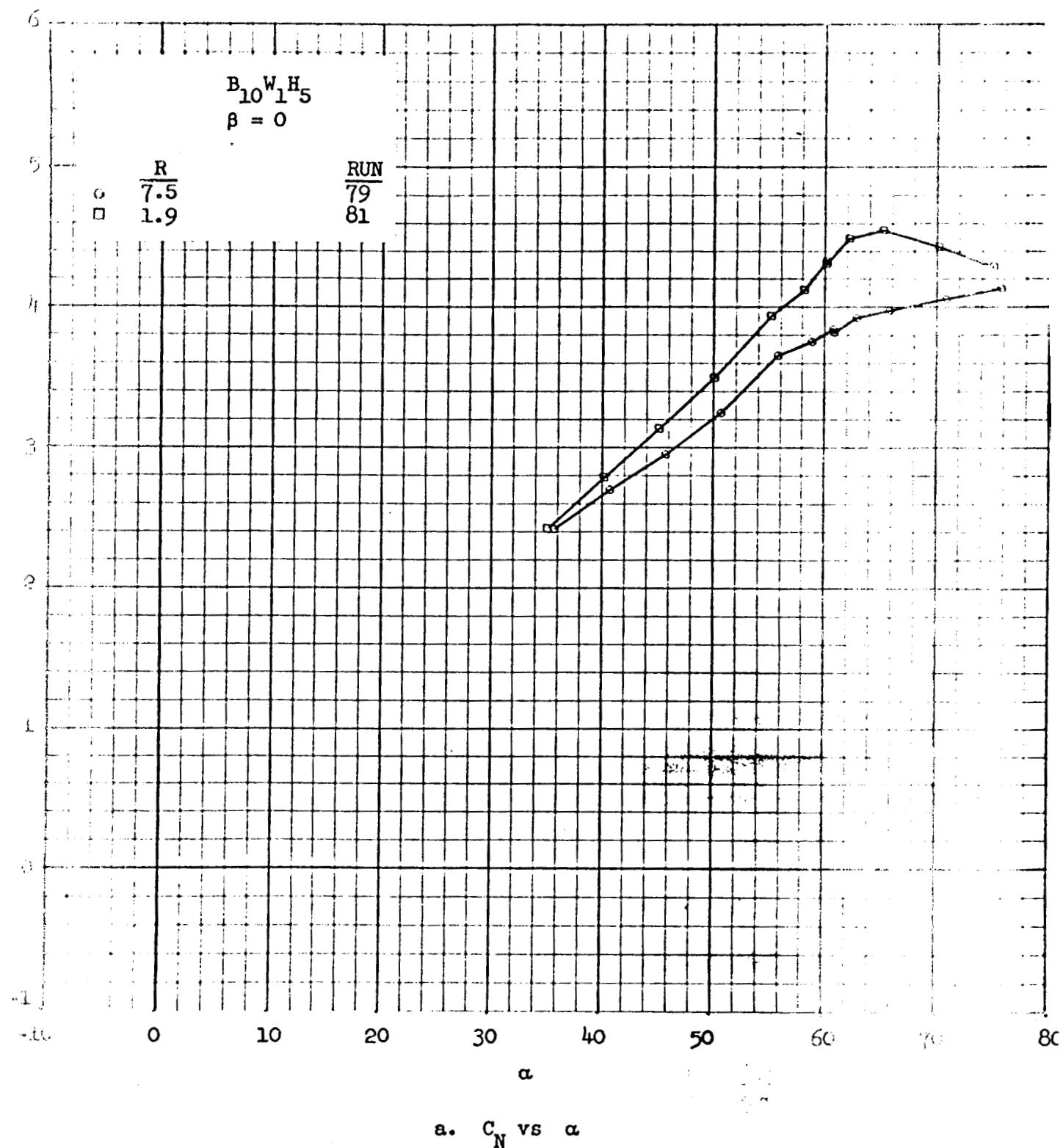
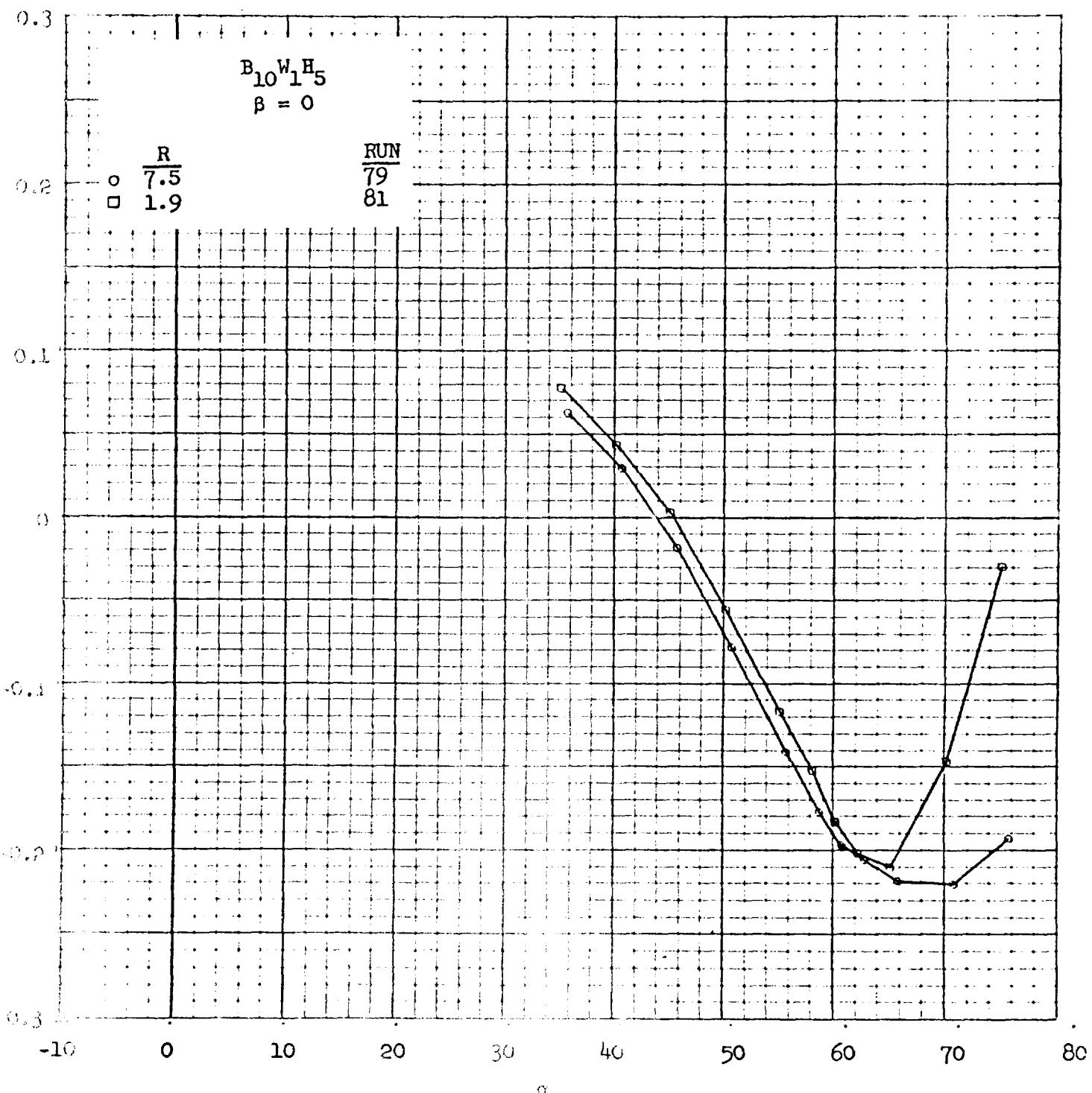


Figure 23. - Effect of angle of attack on longitudinal characteristics at various Reynolds numbers for several model configurations, $B_{10}W_1H_5$.

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National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



b. C_R vs α

Figure 23. - continued

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Ames Research Center: MOFFETT FIELD, CALIF.

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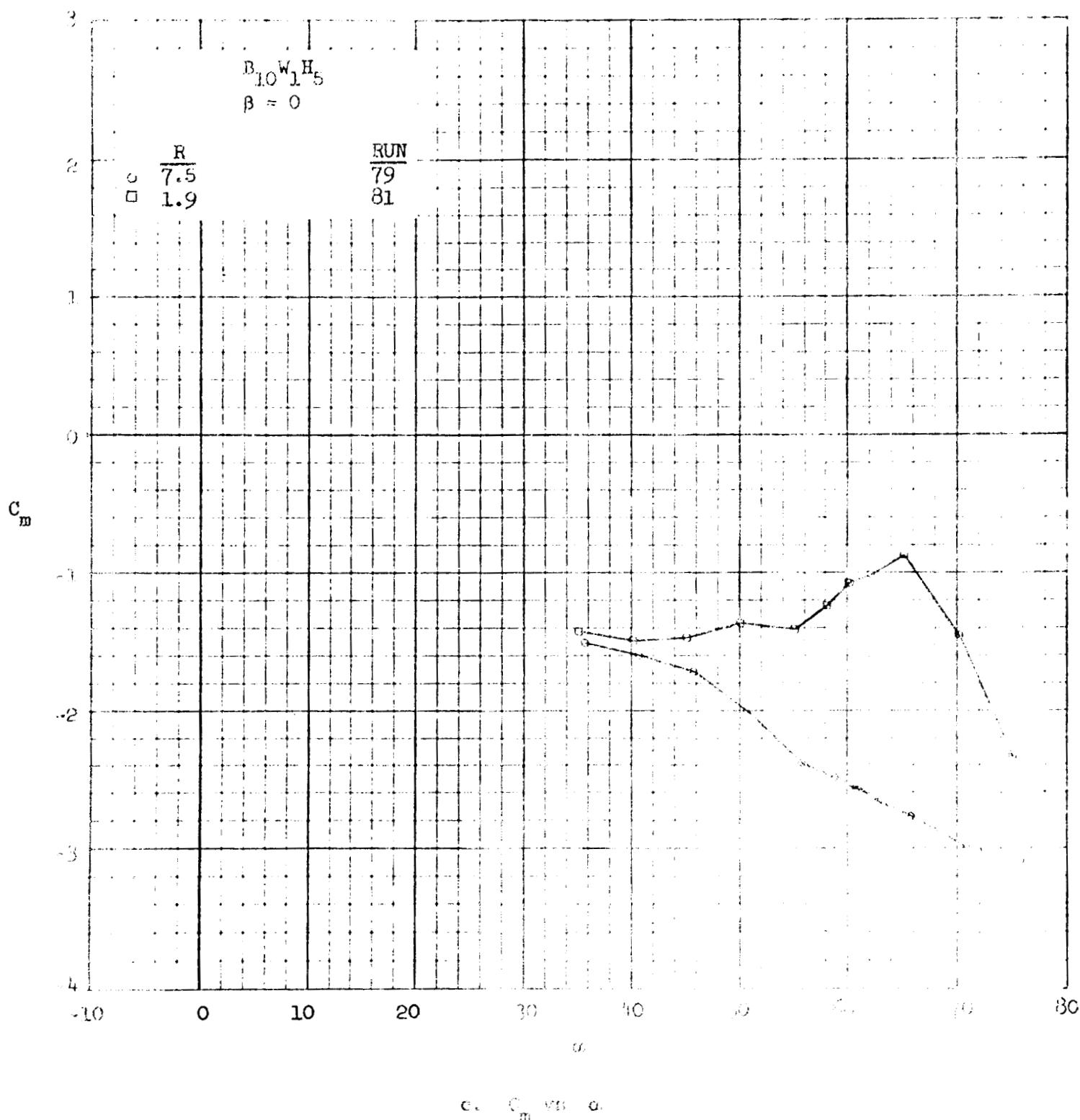


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National Aeronautics and Space Administration
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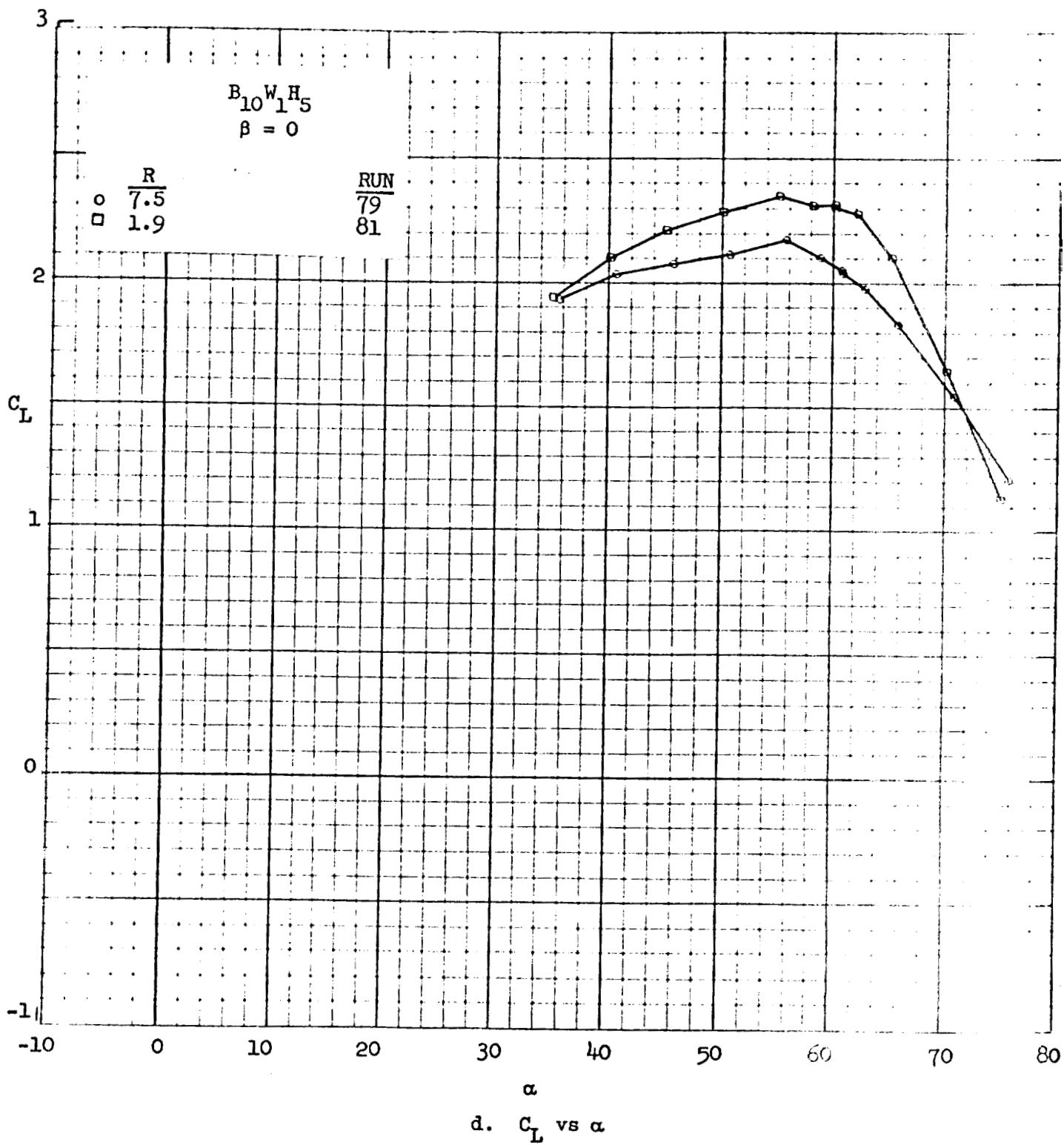
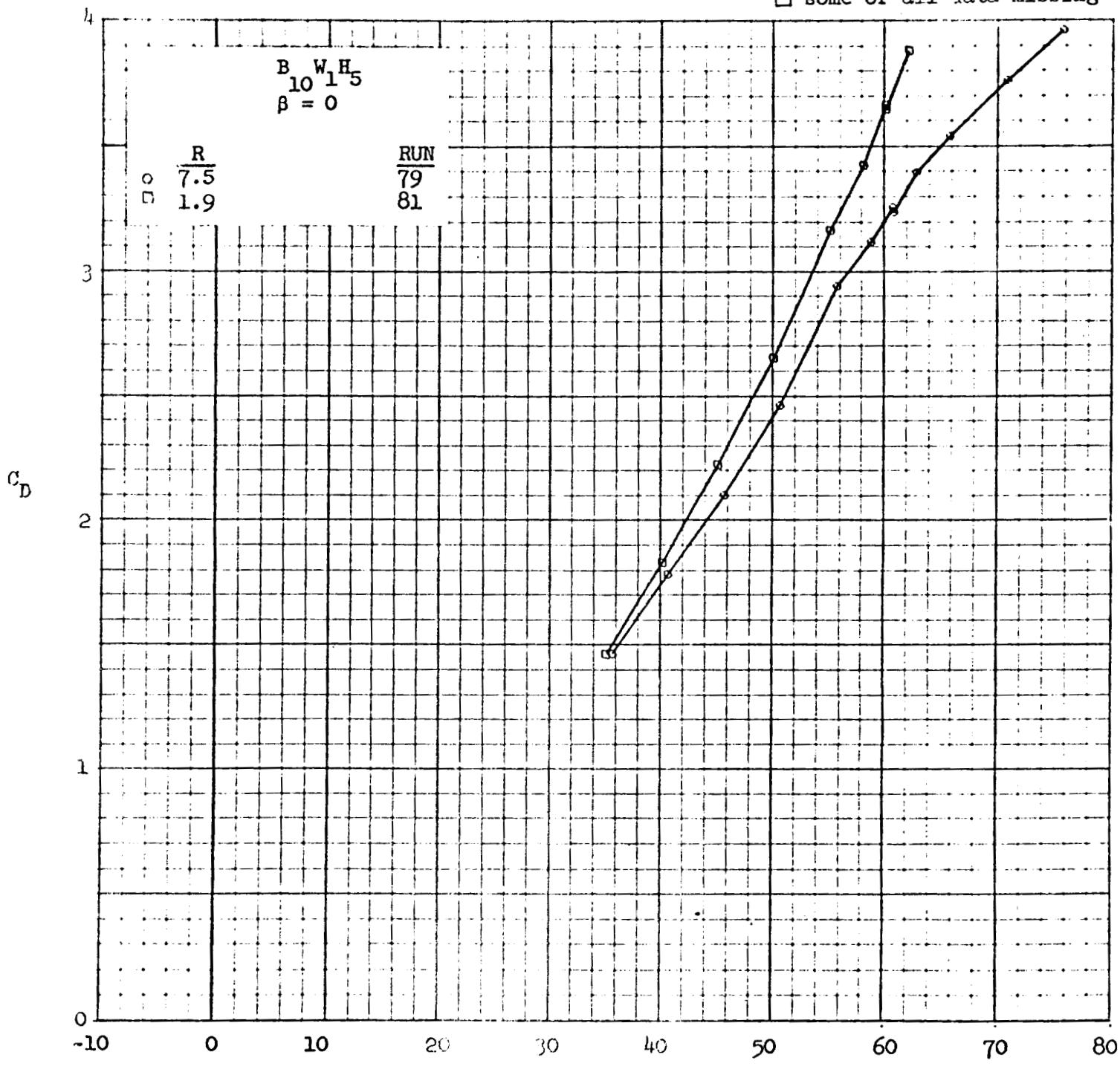


Figure 23. - Continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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e. C_D vs α

Figure 23. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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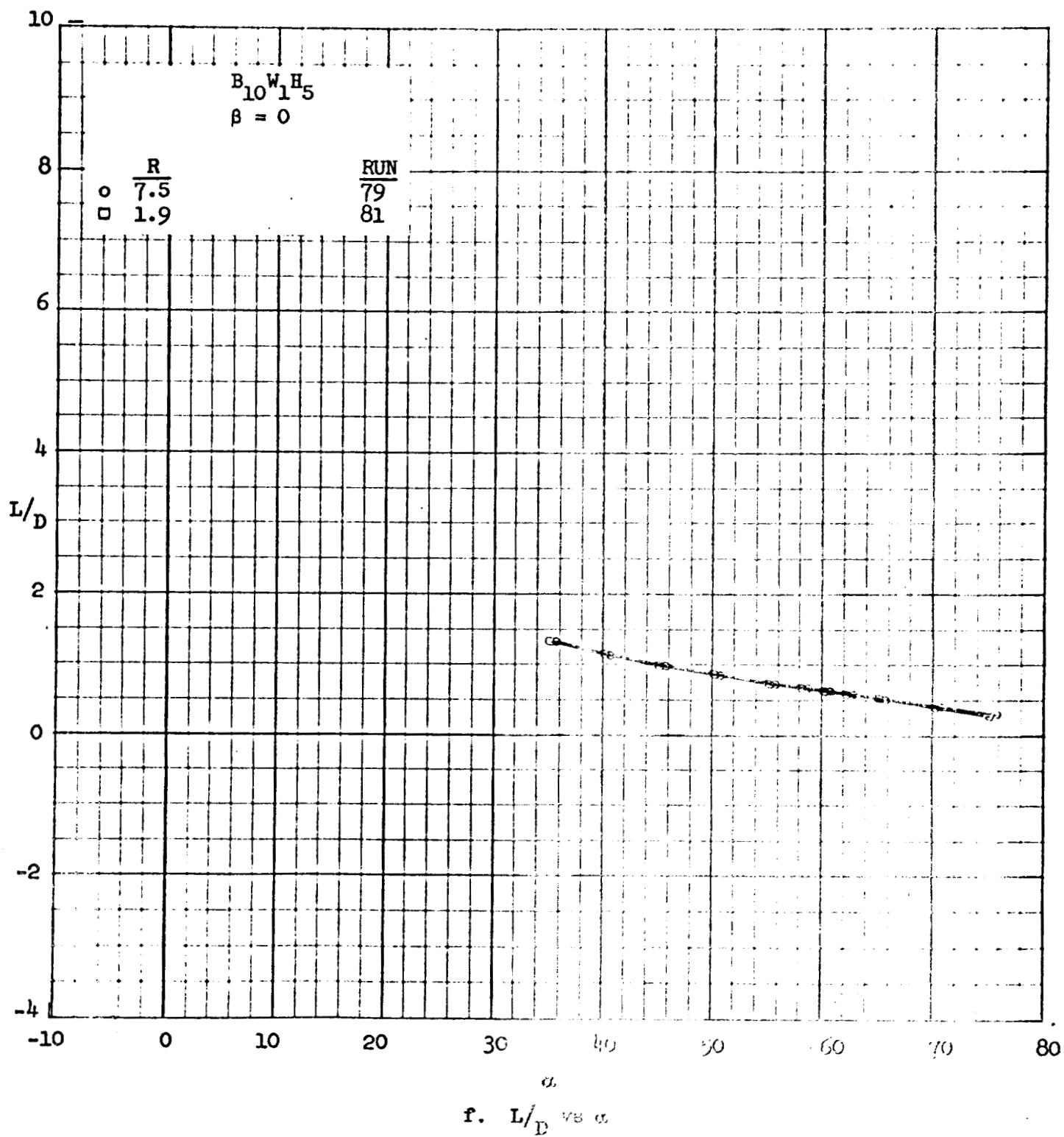
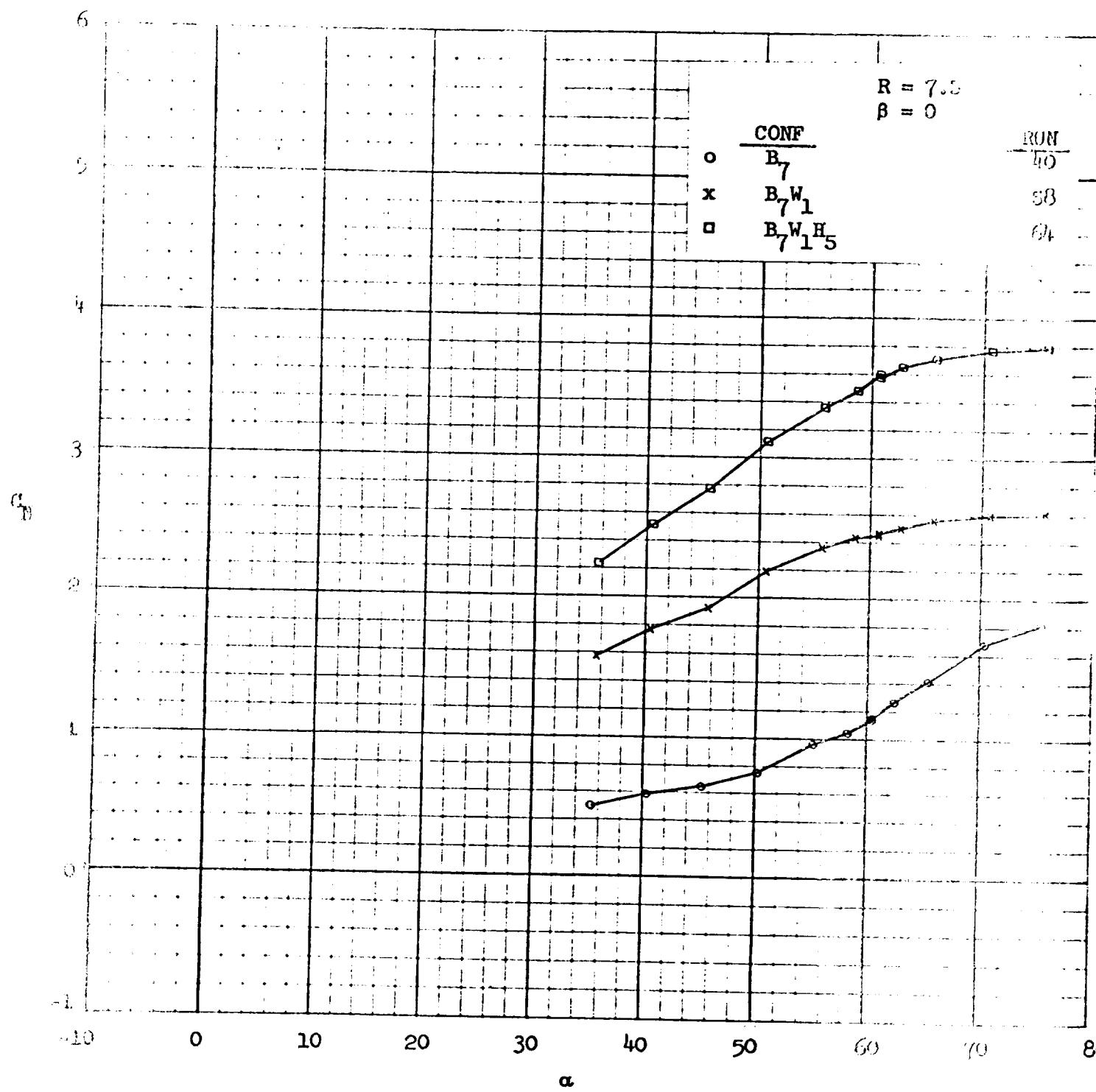


Figure 23 . - Concluded

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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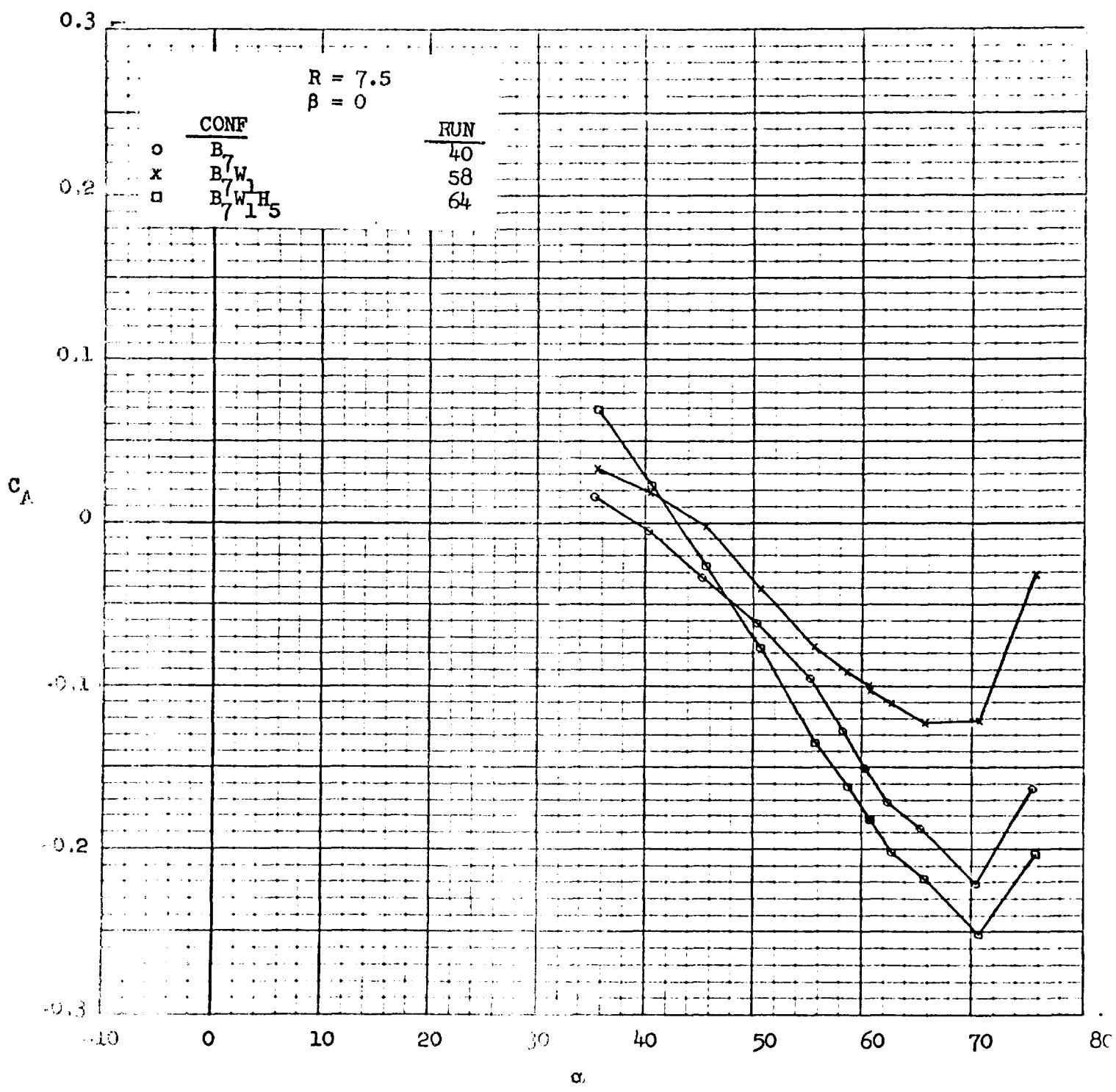


a. C_N vs α

Figure 24. - Effect of angle of attack on longitudinal characteristics during model buildup, $R = 7.5$, $B_7W_1H_5$.

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



b. C_A vs α

Figure 24. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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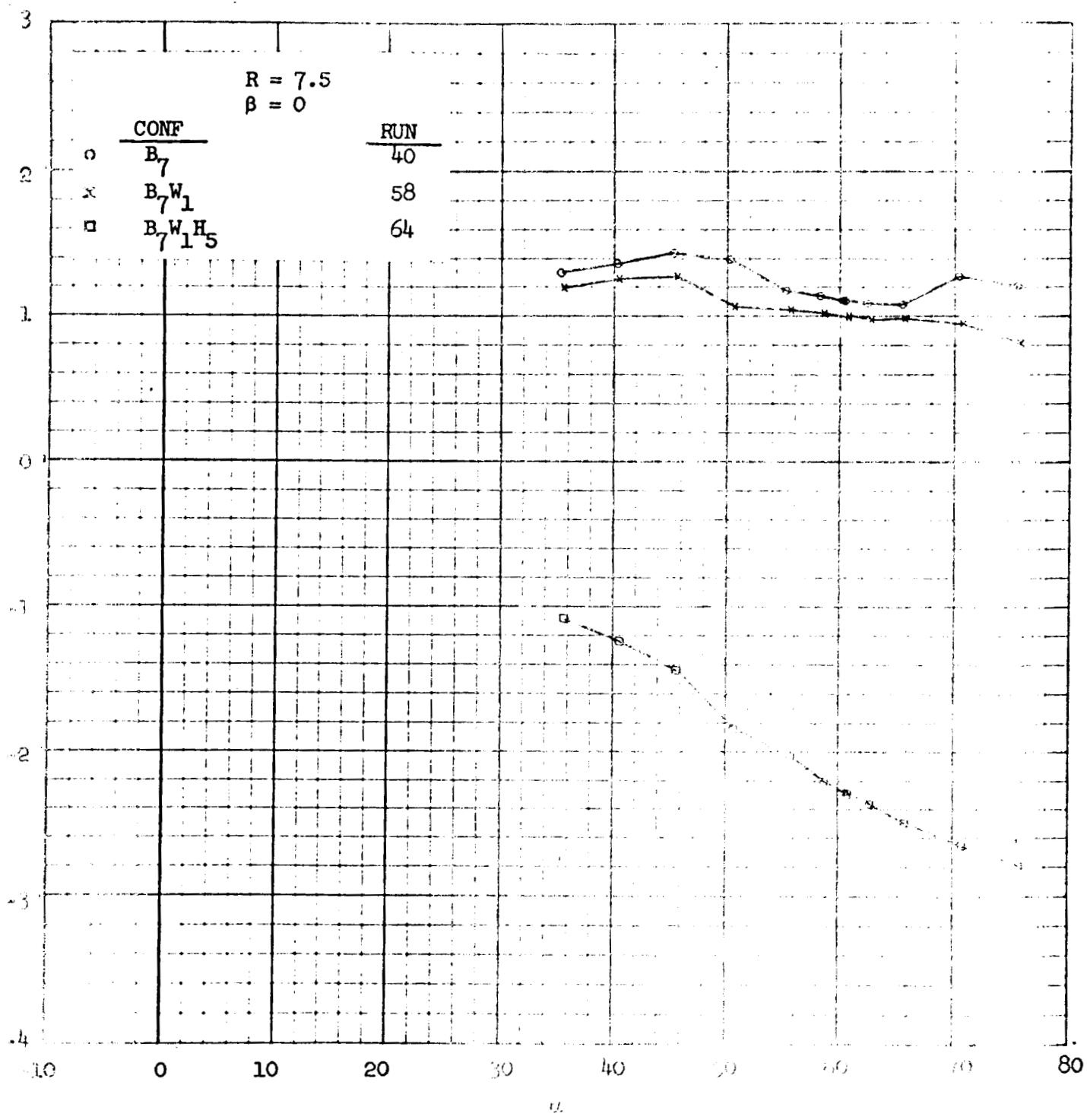


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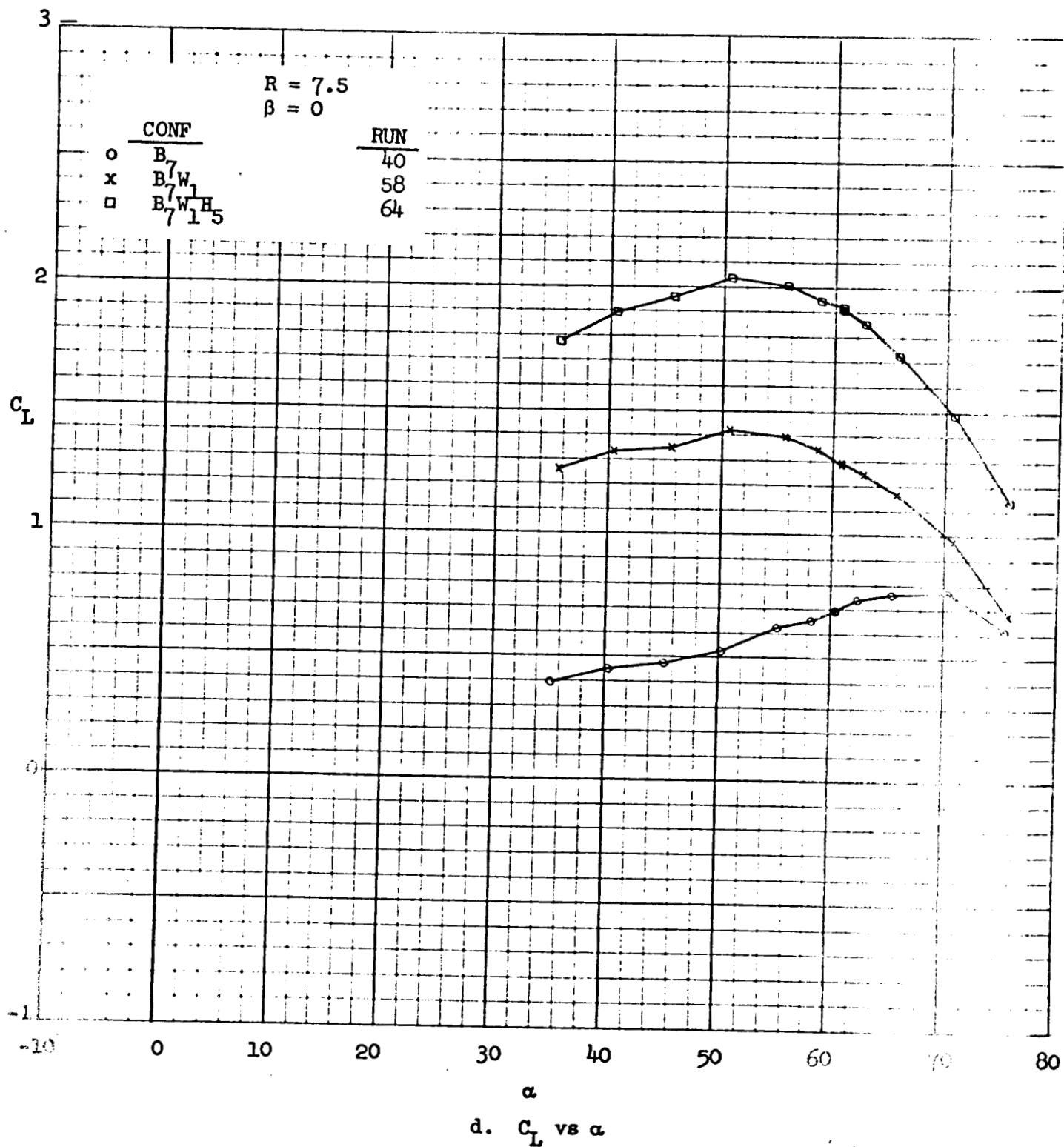
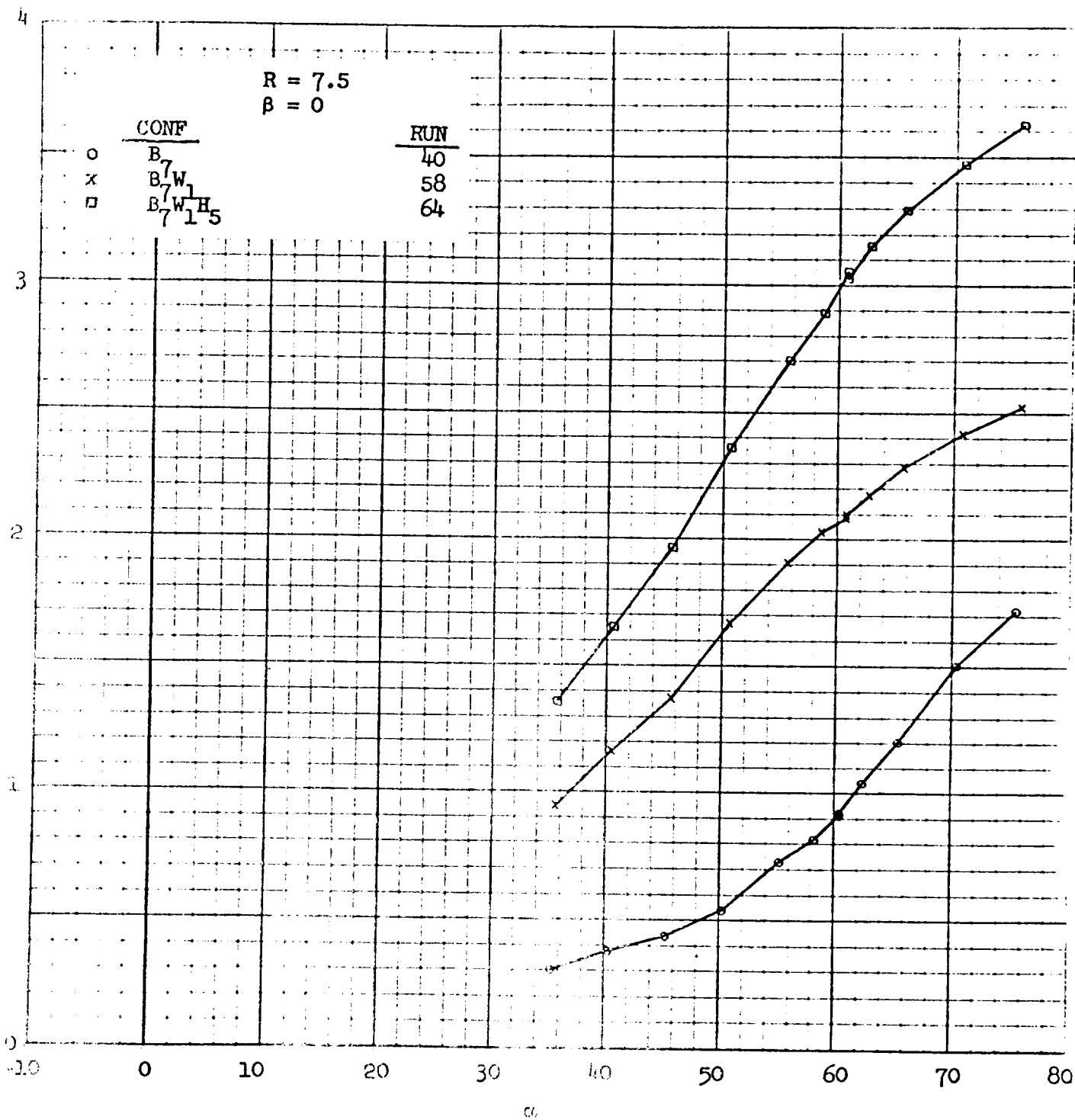


Figure 24. - Continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



e. C_D vs. α .

Figure 24. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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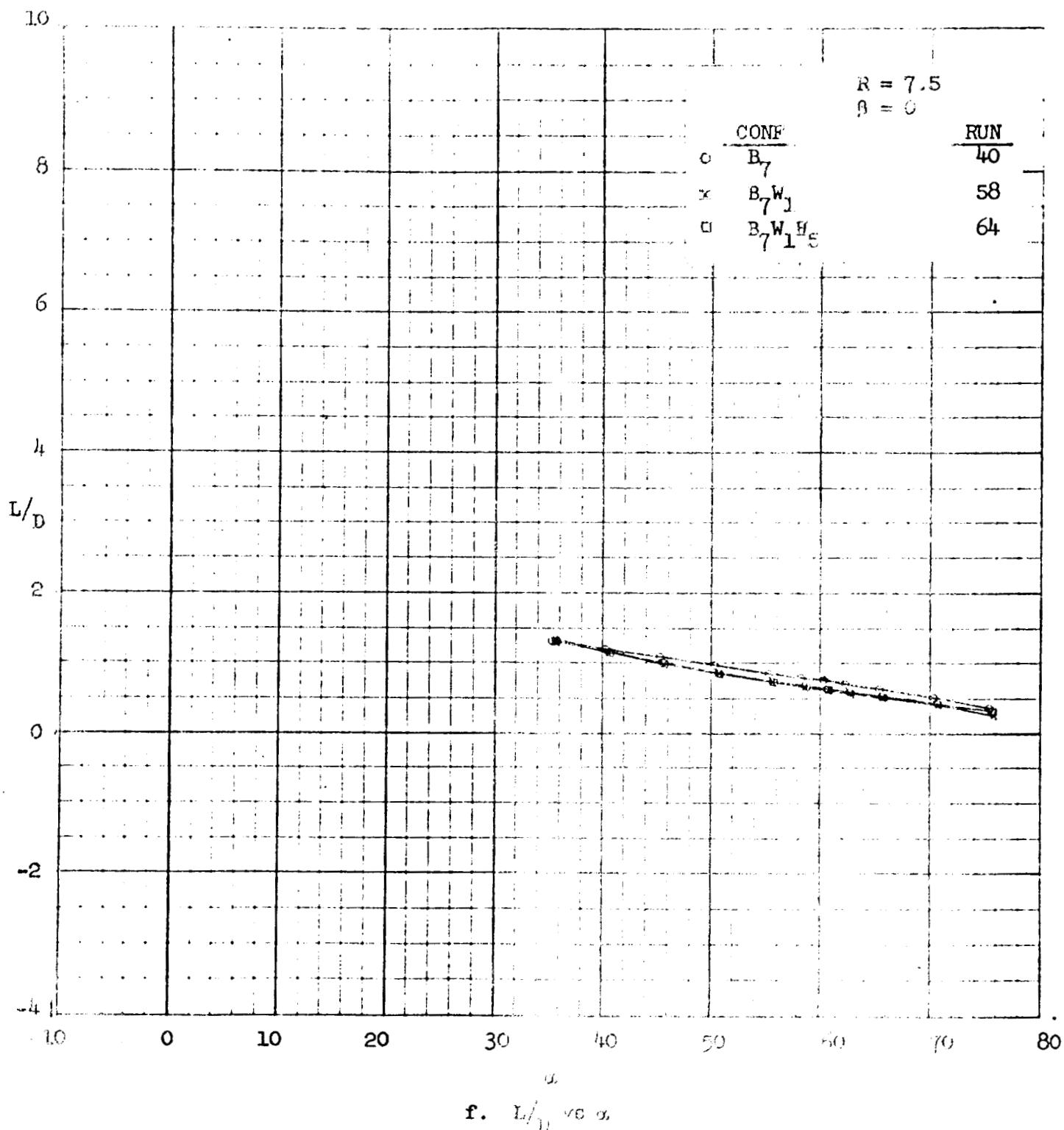
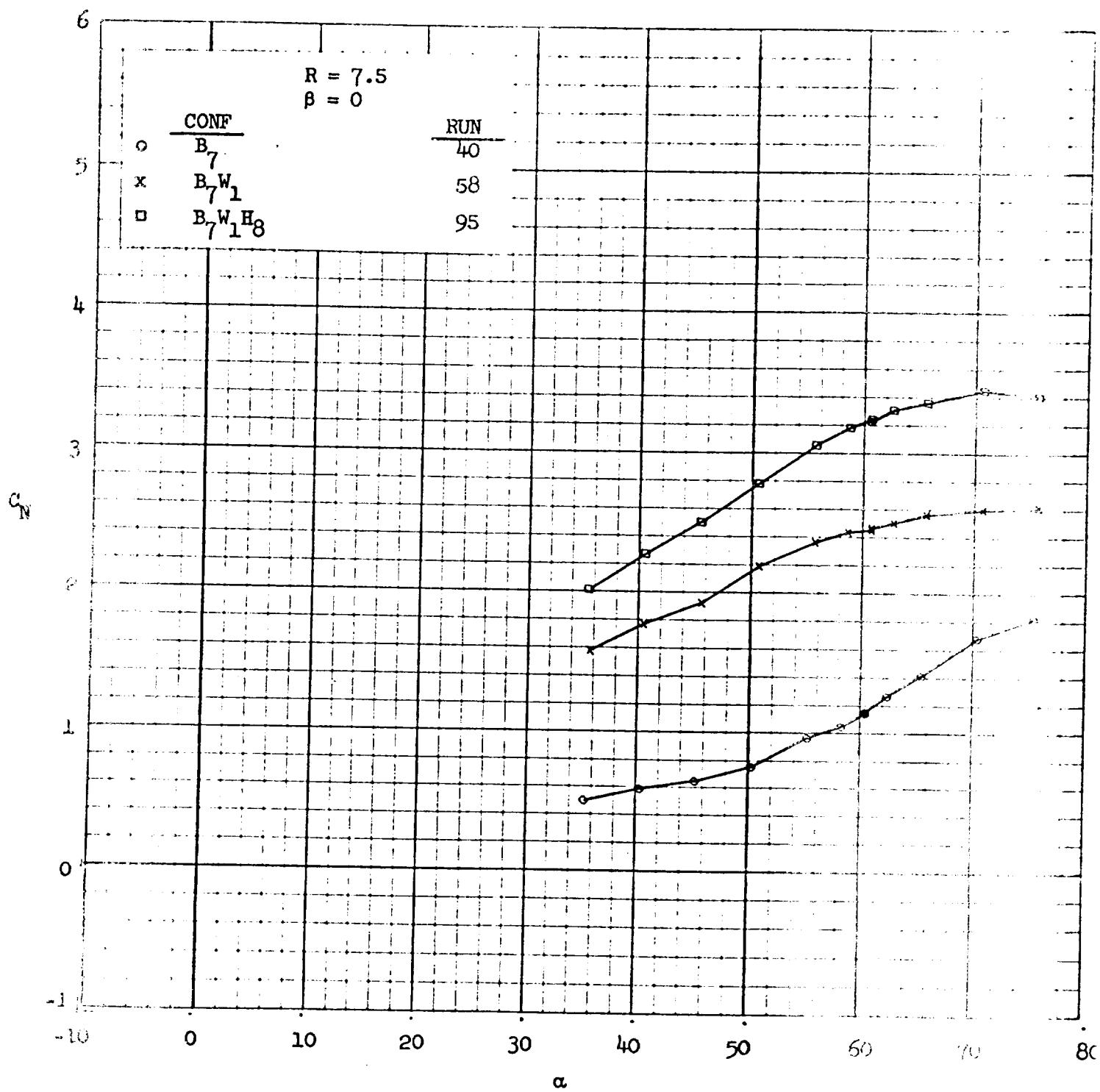


Figure 24. - Concluded

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



a. C_N vs α

Figure 25. - Effect of angle of attack on longitudinal characteristics of the model buildup, $R = 7.5$, $B_W_7_1_H_8$.

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA

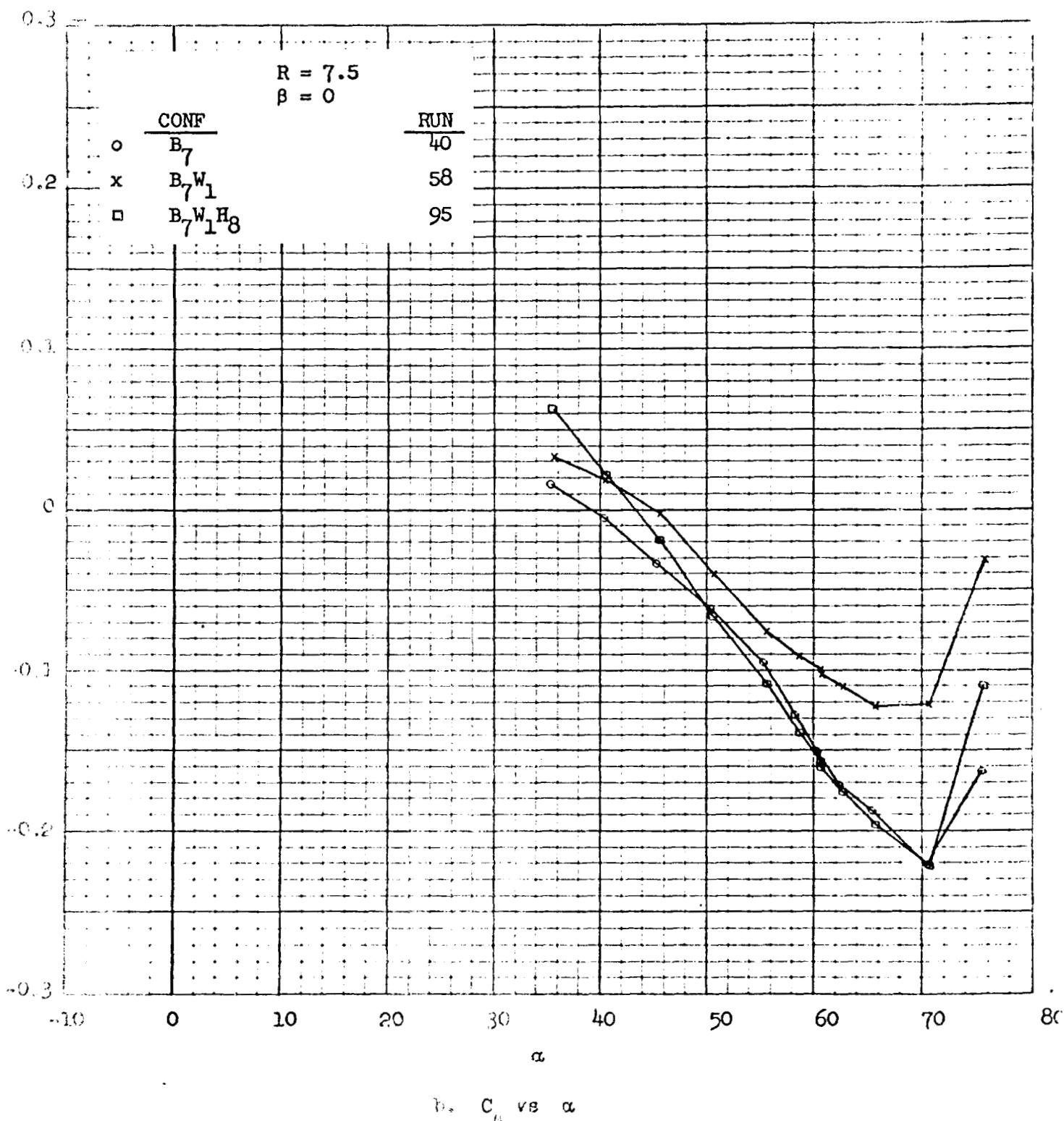
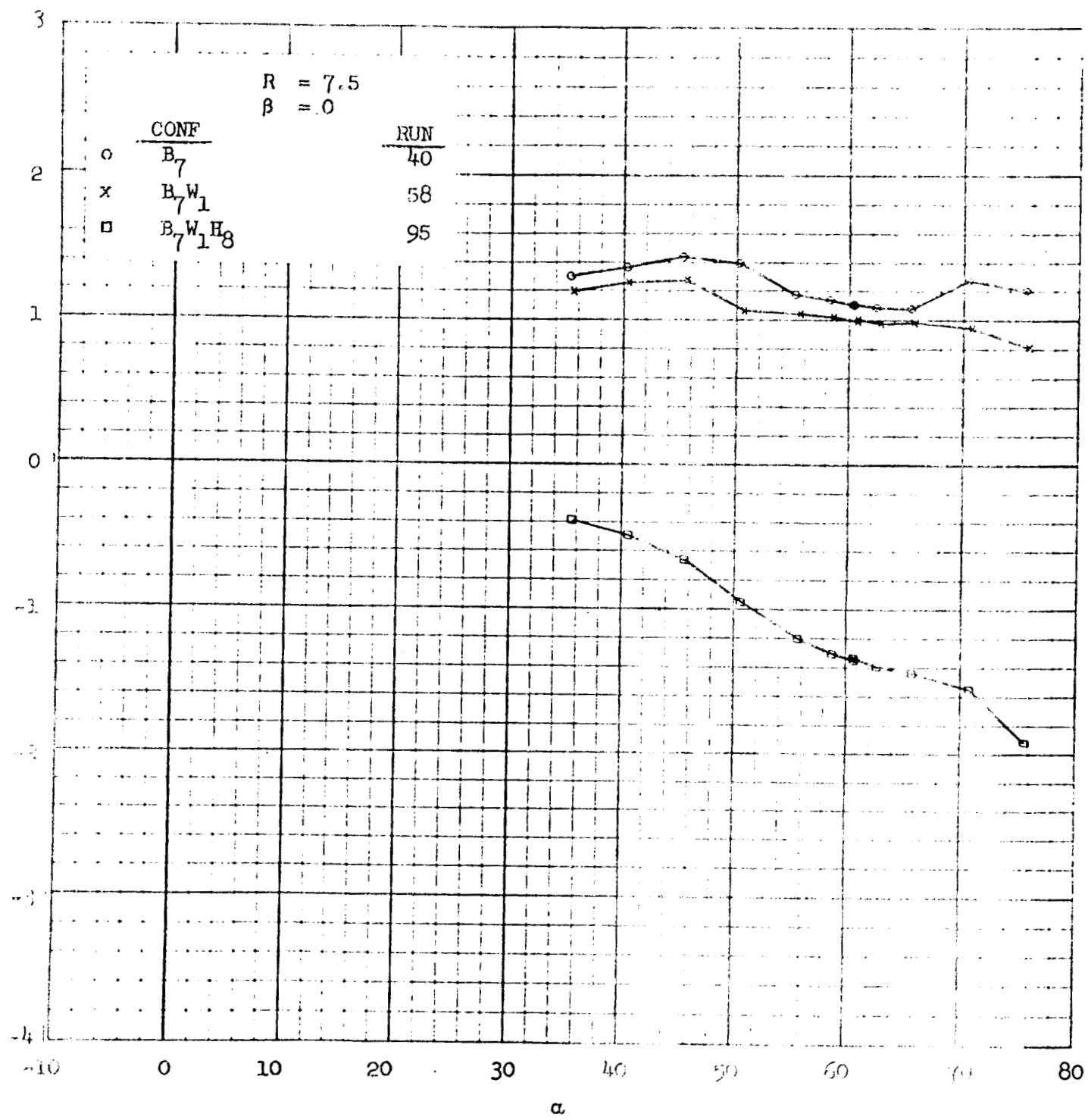


Figure 25. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



c. C_m vs α

Figure 25. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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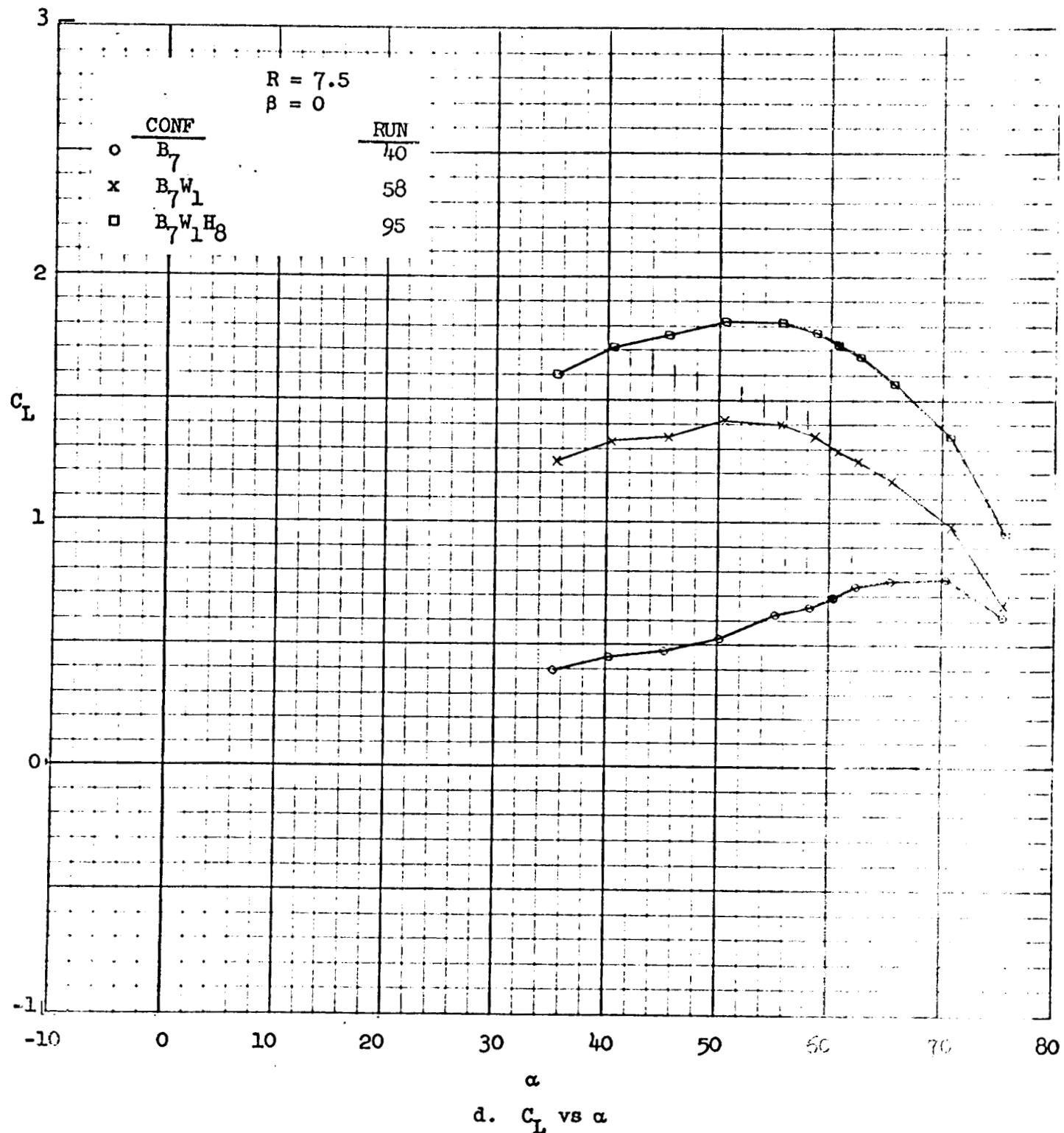
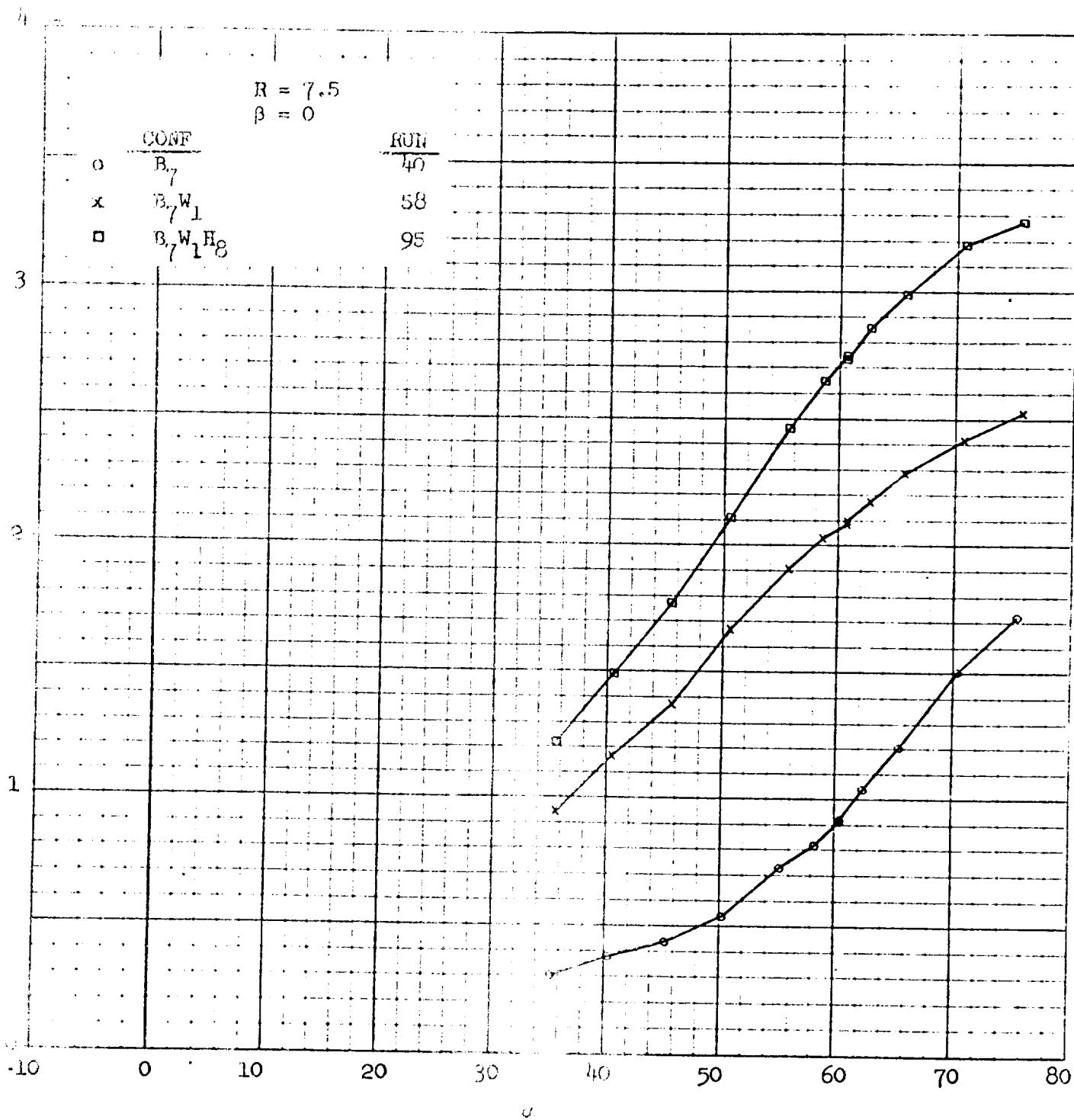


Figure 25. - Continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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e. C_D vs. U

Figure 25. - continued

National Aeronautics and Space Administration
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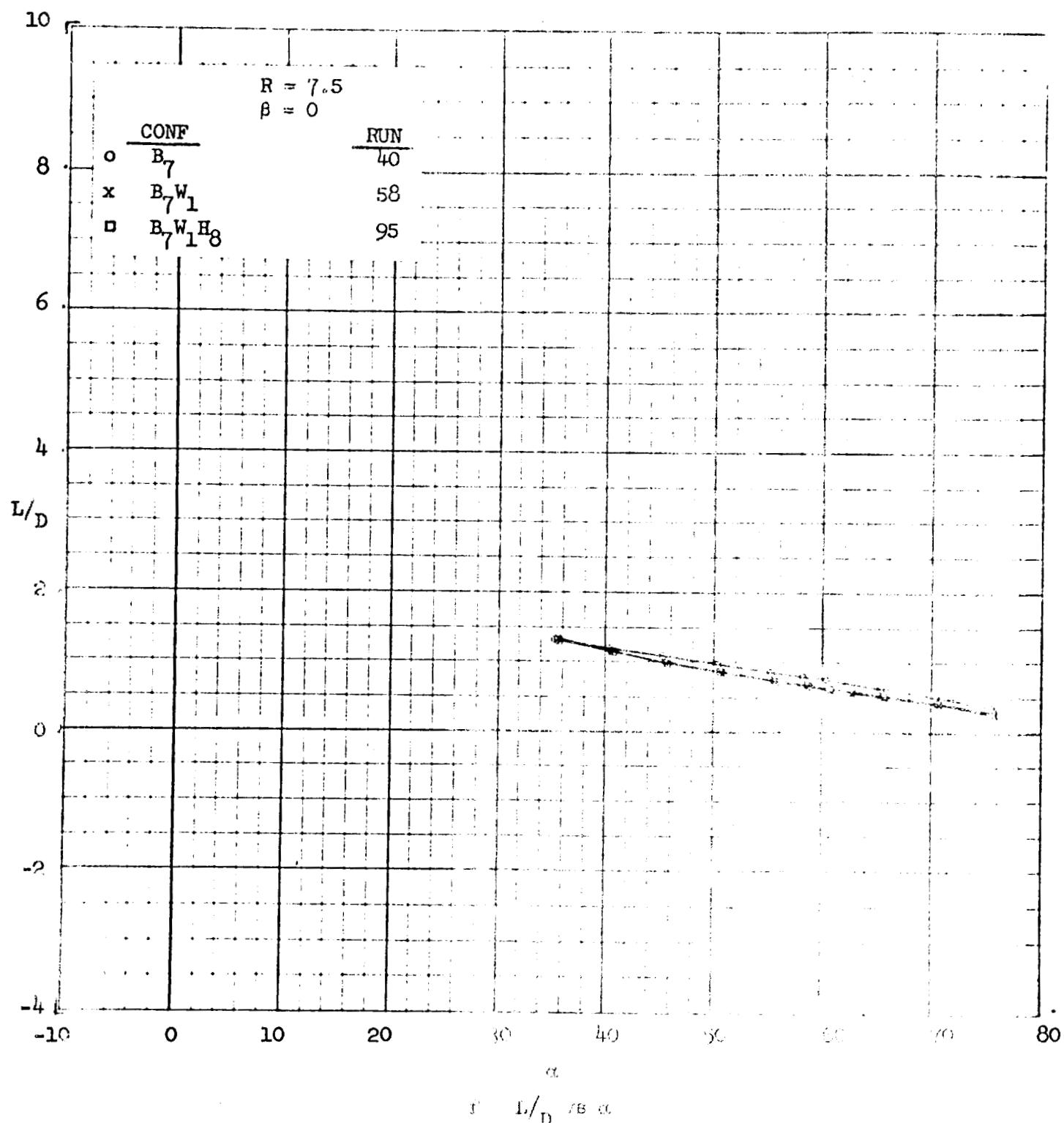


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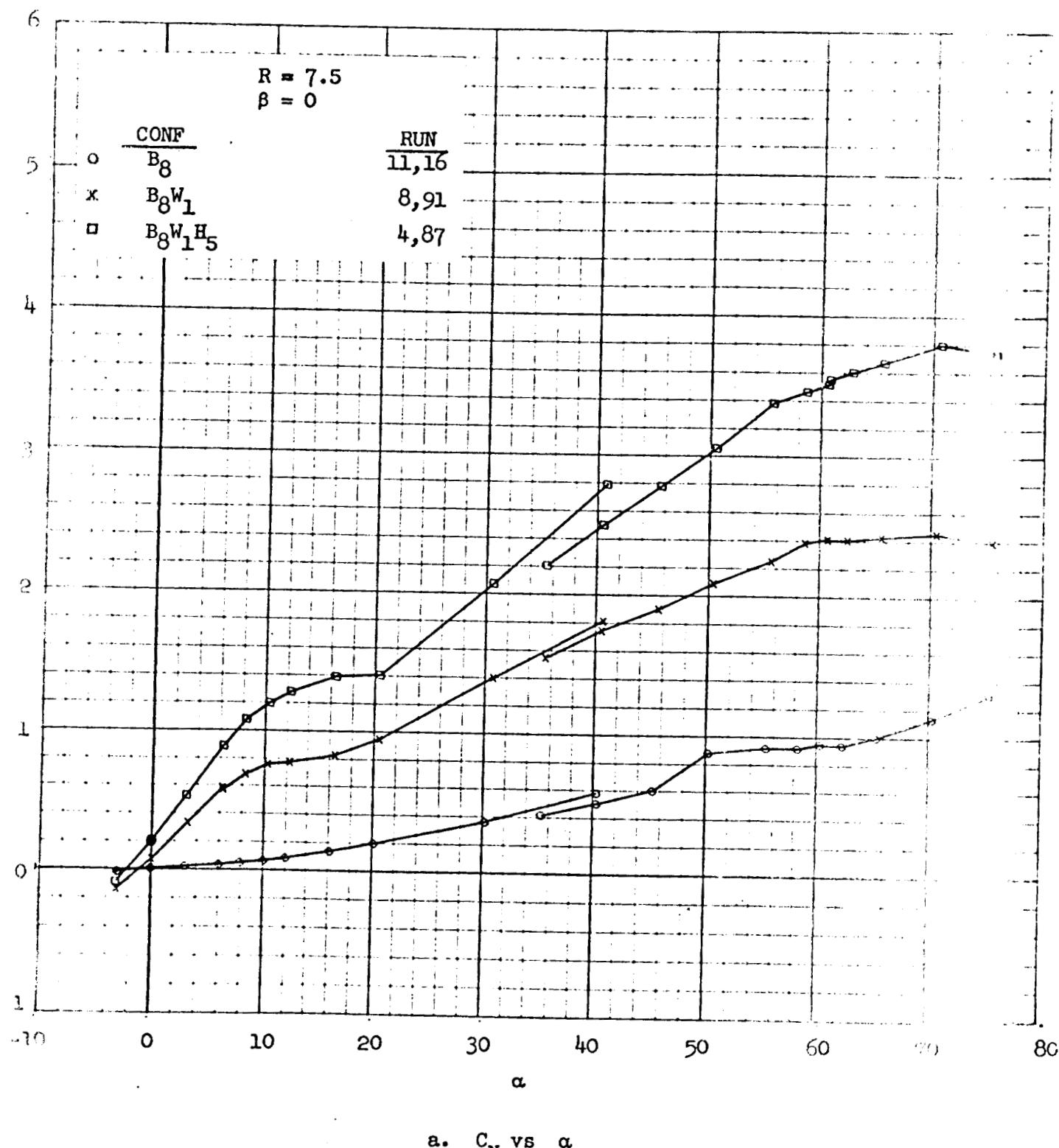
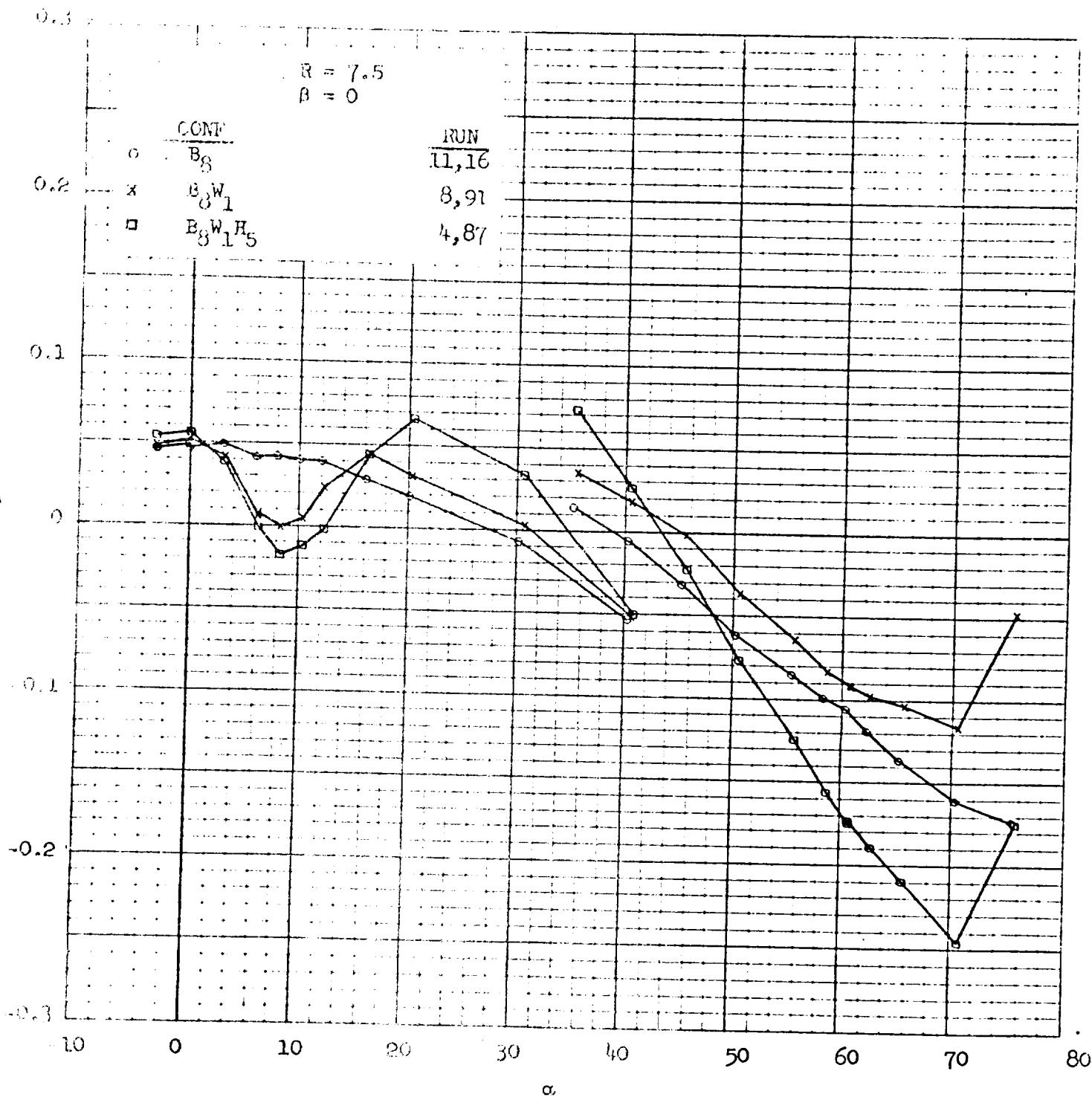


Figure 26. - Effect of angle of attack on longitudinal characteristics during model buildup, $R = 7.5$, $B_8 W_1 H_5$.

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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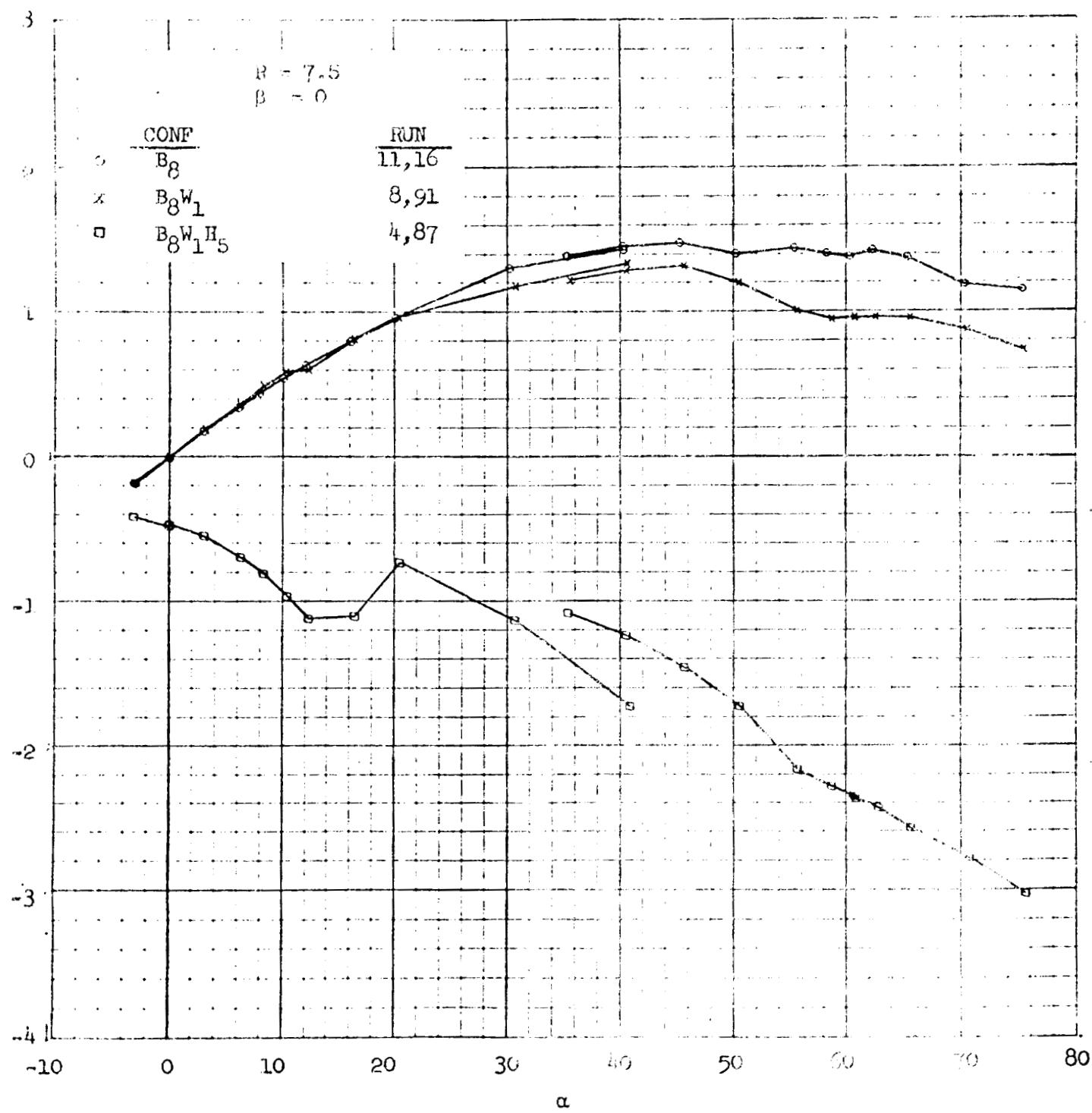


b. C_A vs α

Figure 26. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



c. C_m vs α

Figure 26. - continued

National Aeronautics and Space Administration
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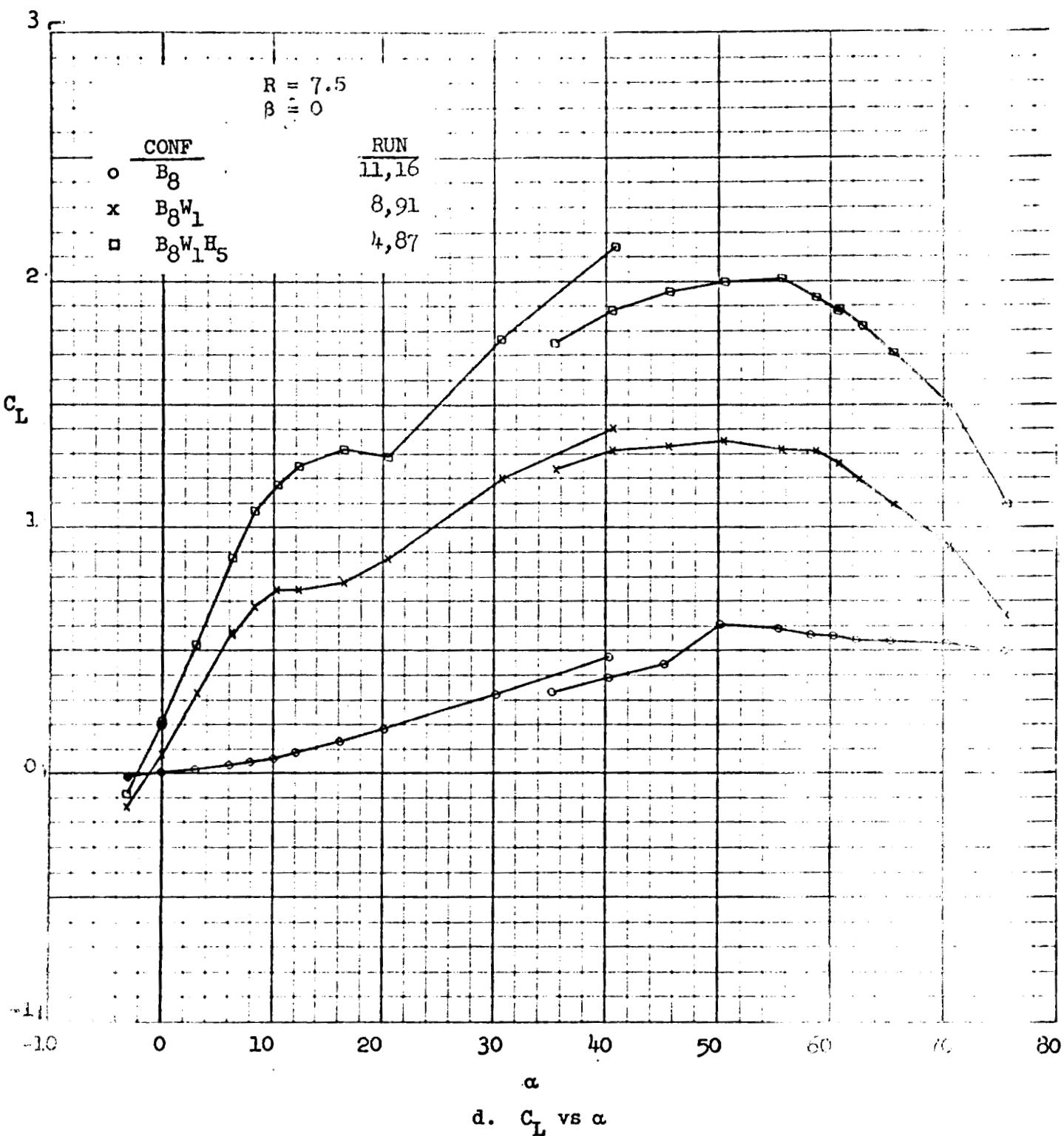
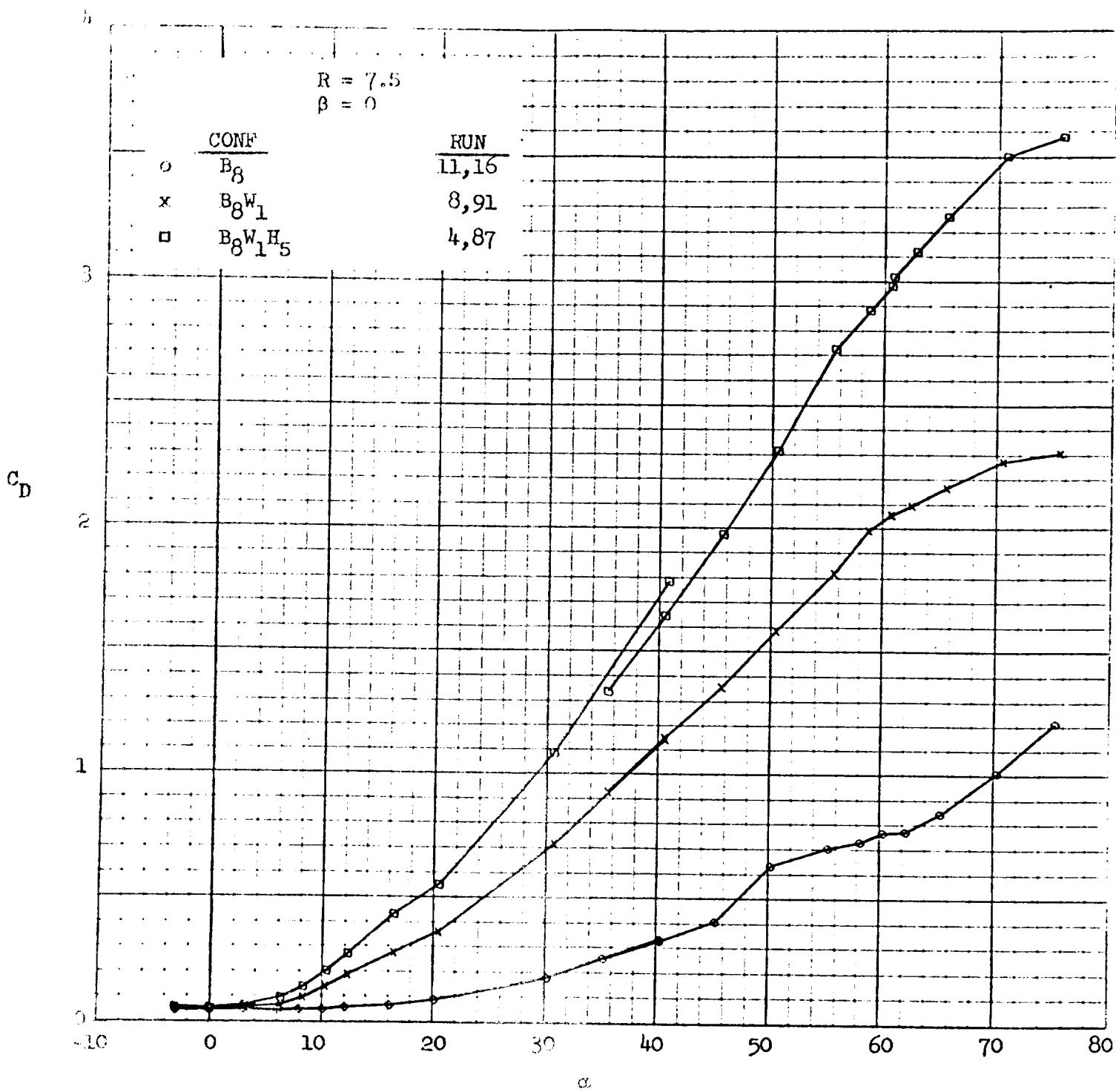


Figure 26. - Continued

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Ames Research Center: MOFFETT FIELD, CALIF.

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e. C_D vs α

Figure 26. - continued

National Aeronautics and Space Administration
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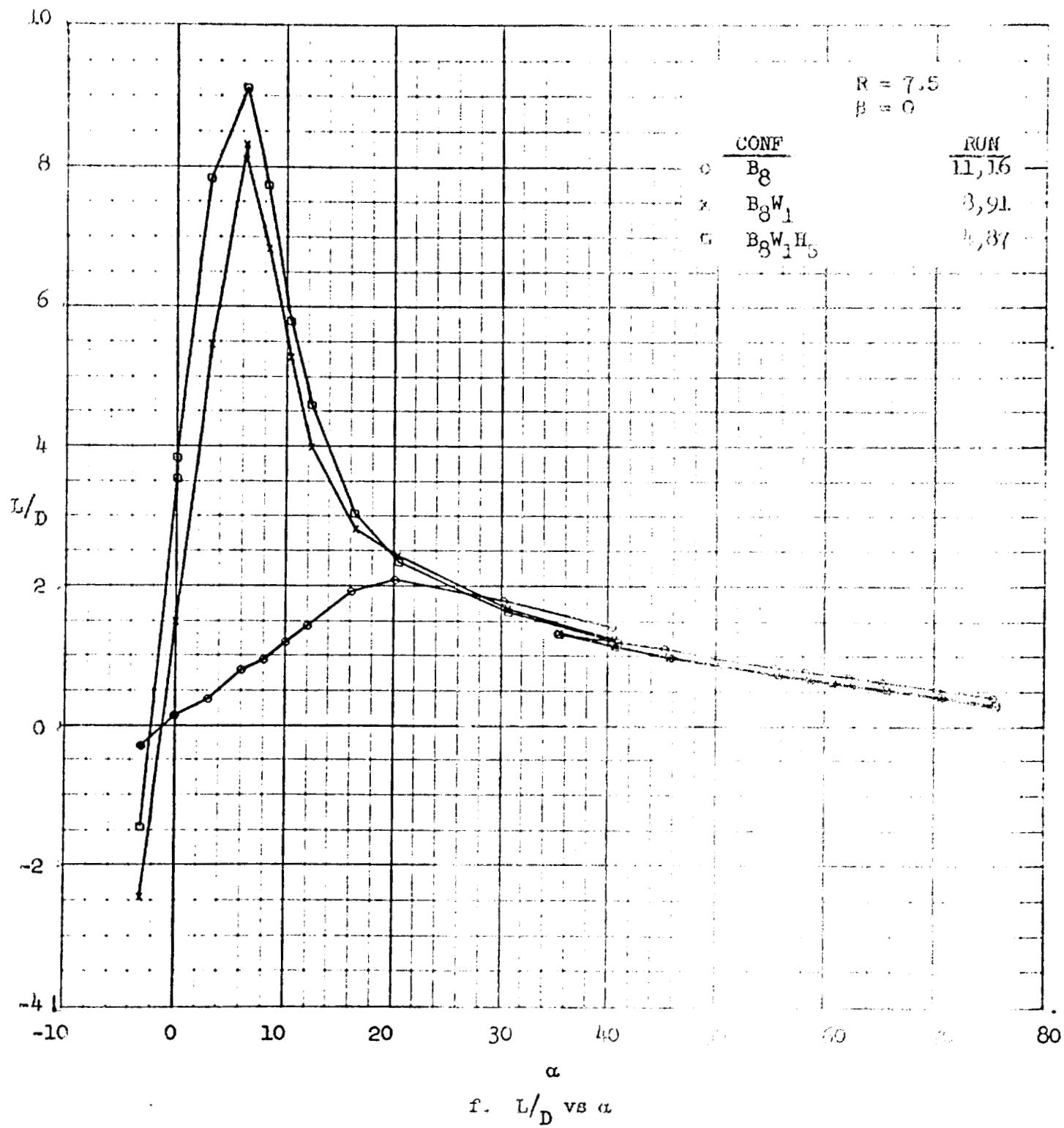


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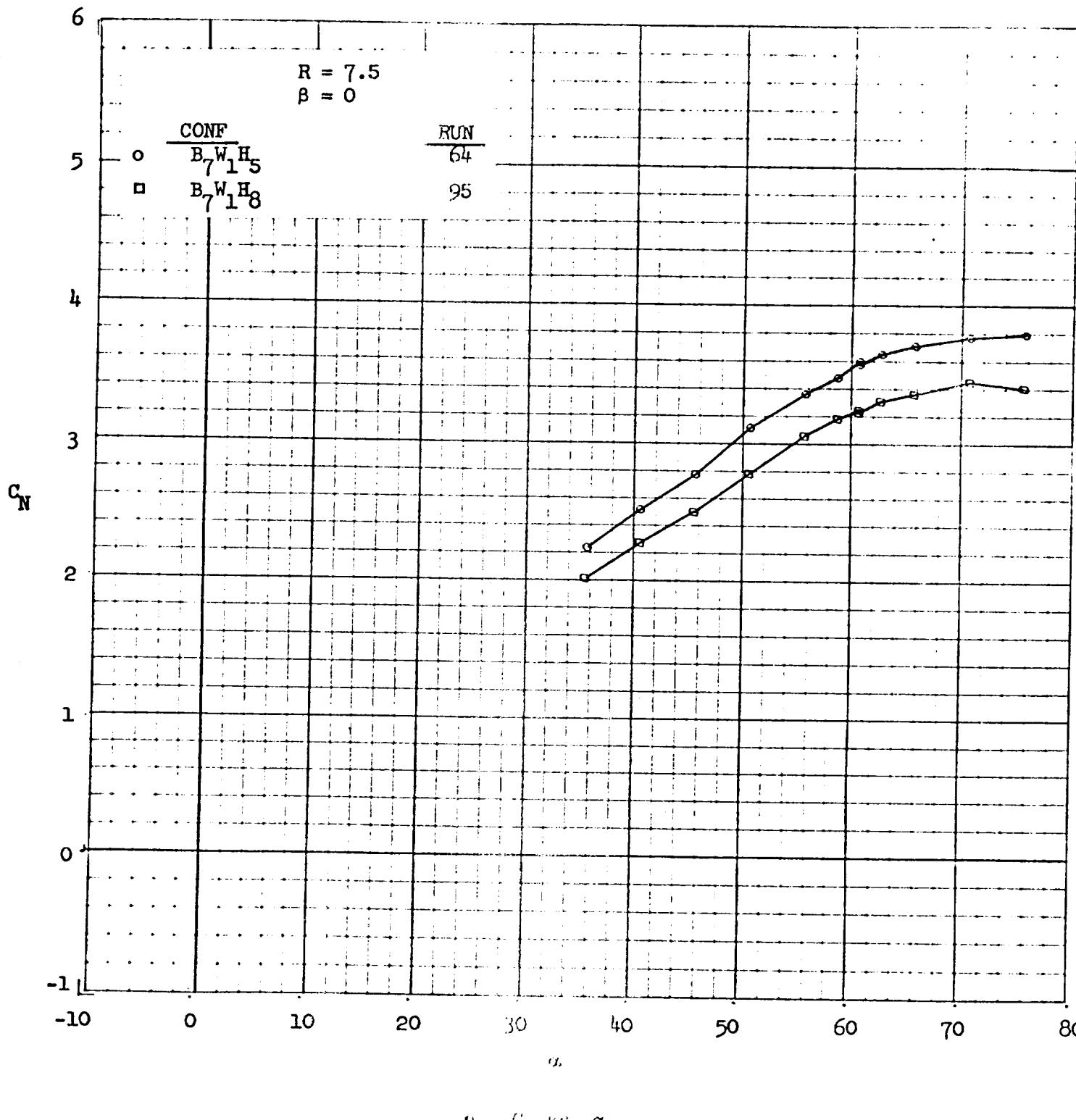


Figure 27. - Effect of angle of attack on longitudinal characteristics for various horizontal stabilizer configurations with body B₇, R = 7.5.
7

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Ames Research Center: MOFFETT FIELD, CALIF.

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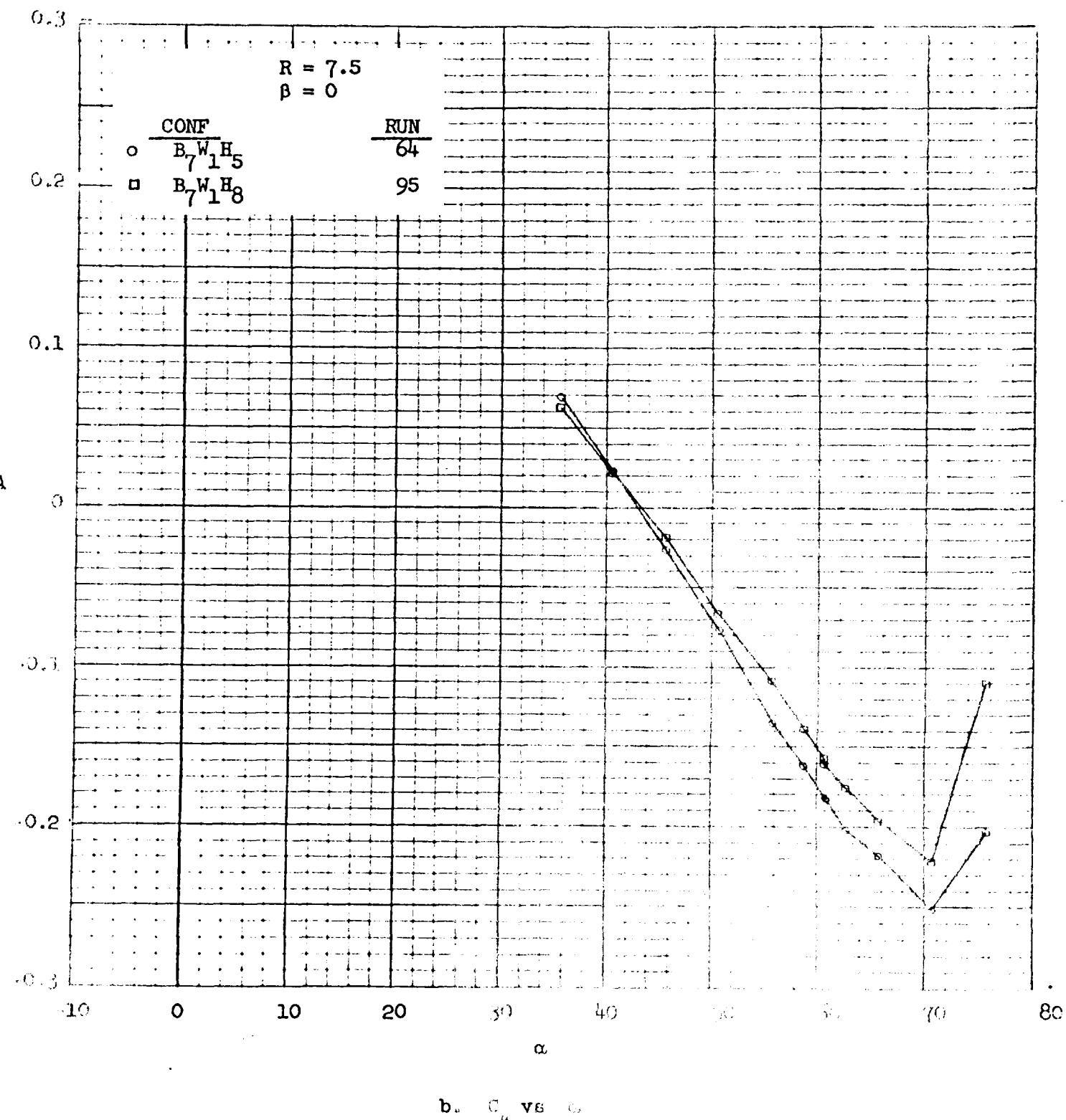
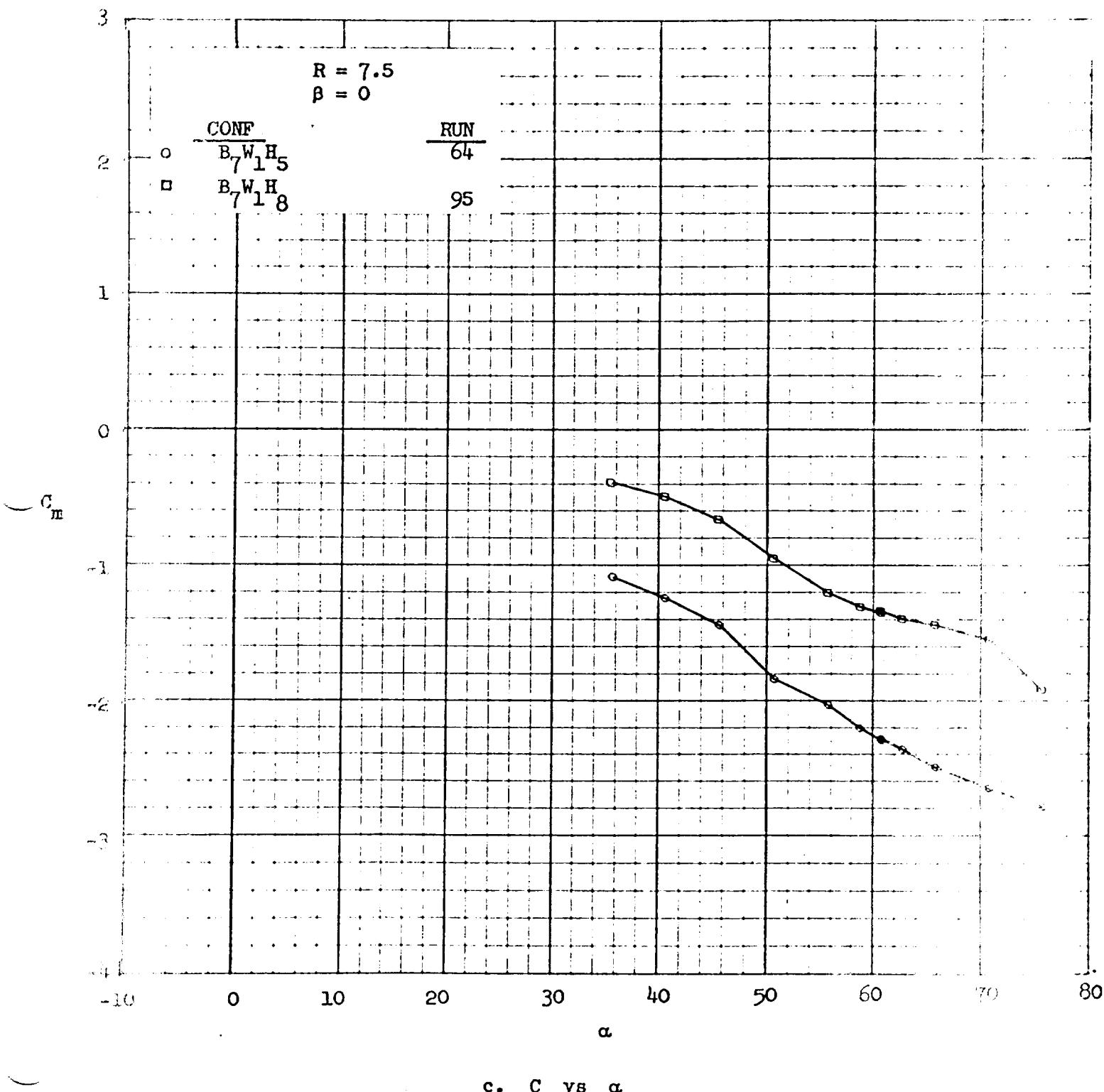


Figure 27. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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c. C_m vs α

Figure 27. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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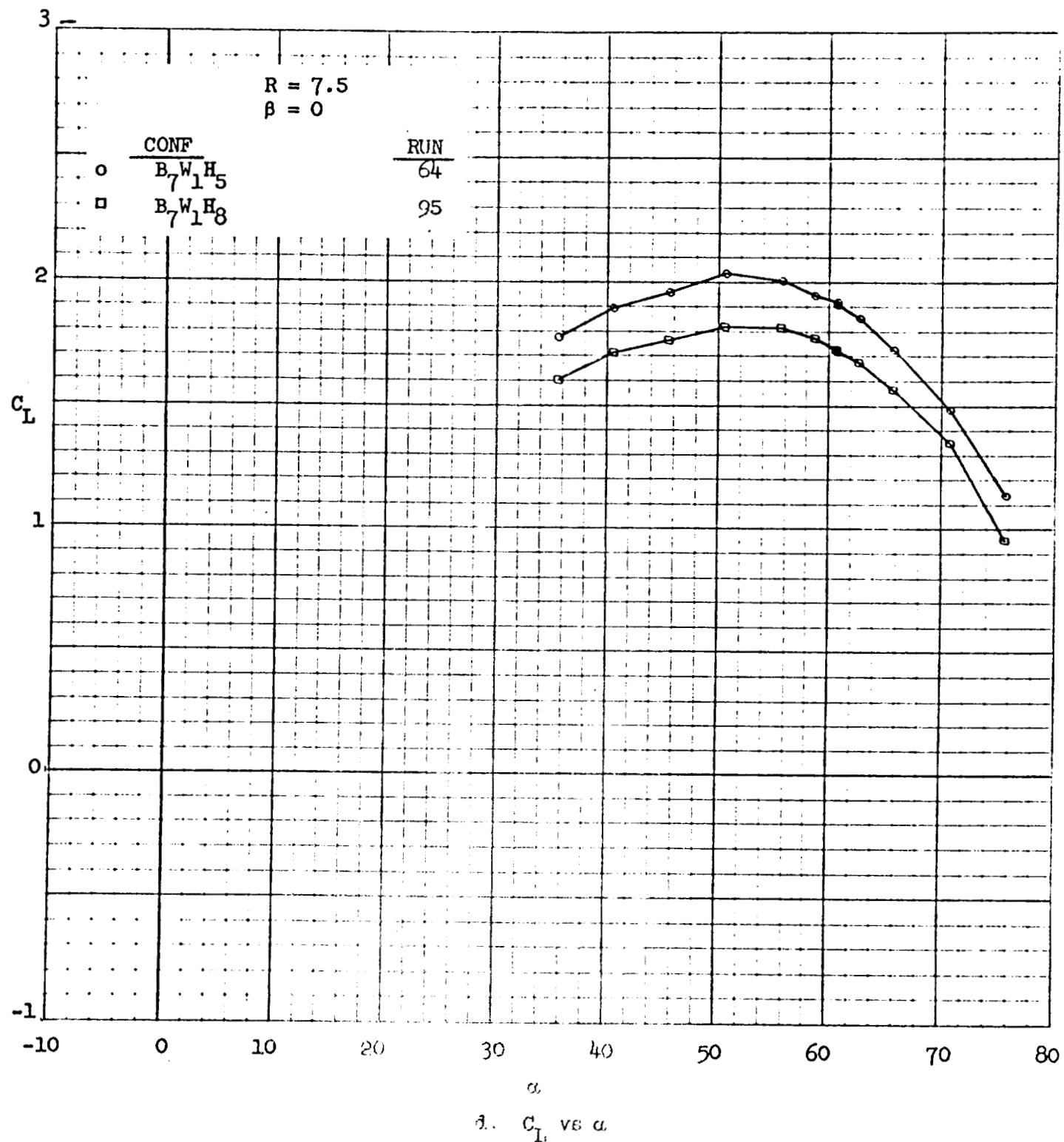
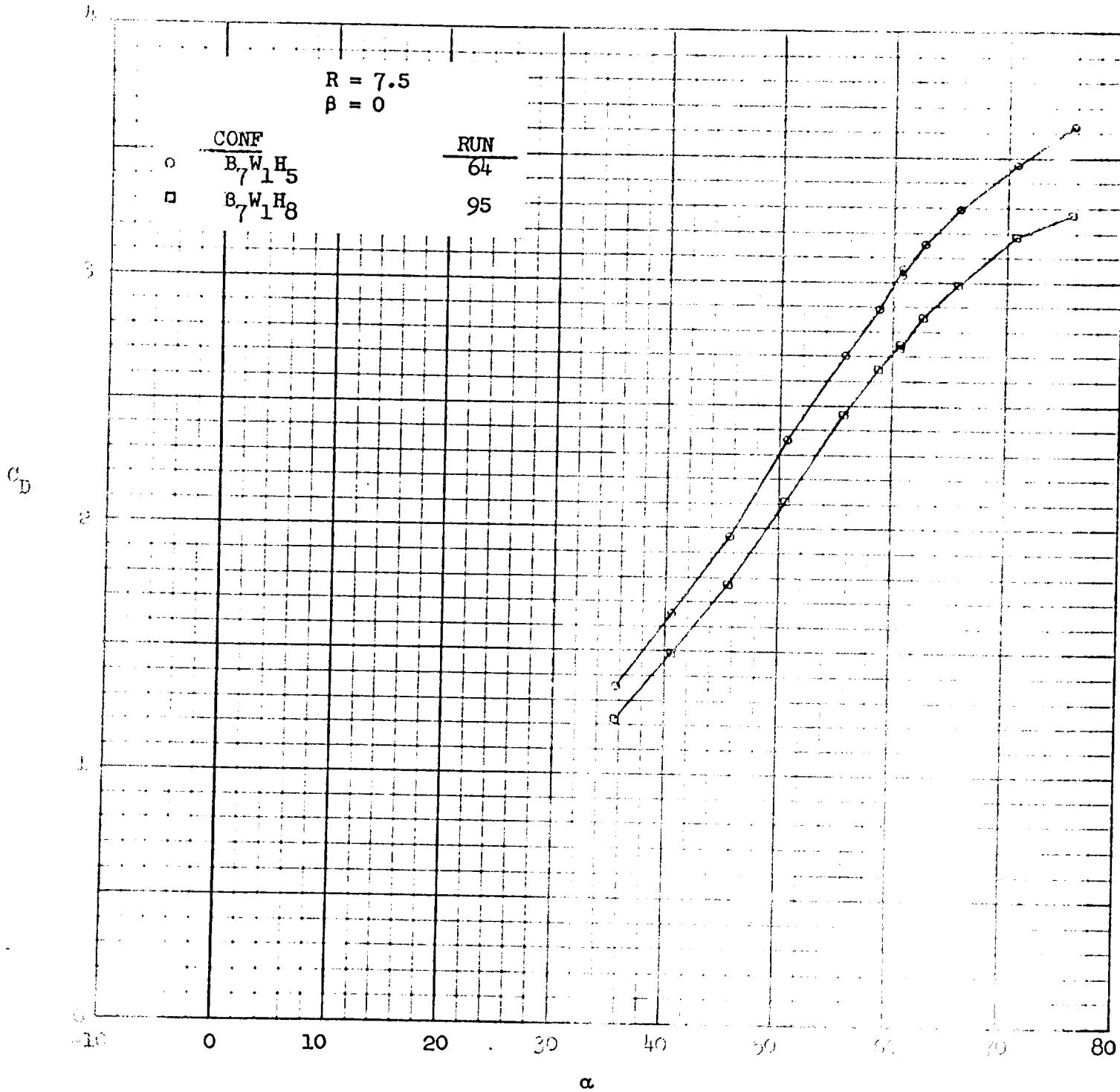


Figure 27. - Continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



e. C_D vs. α

Figure 27. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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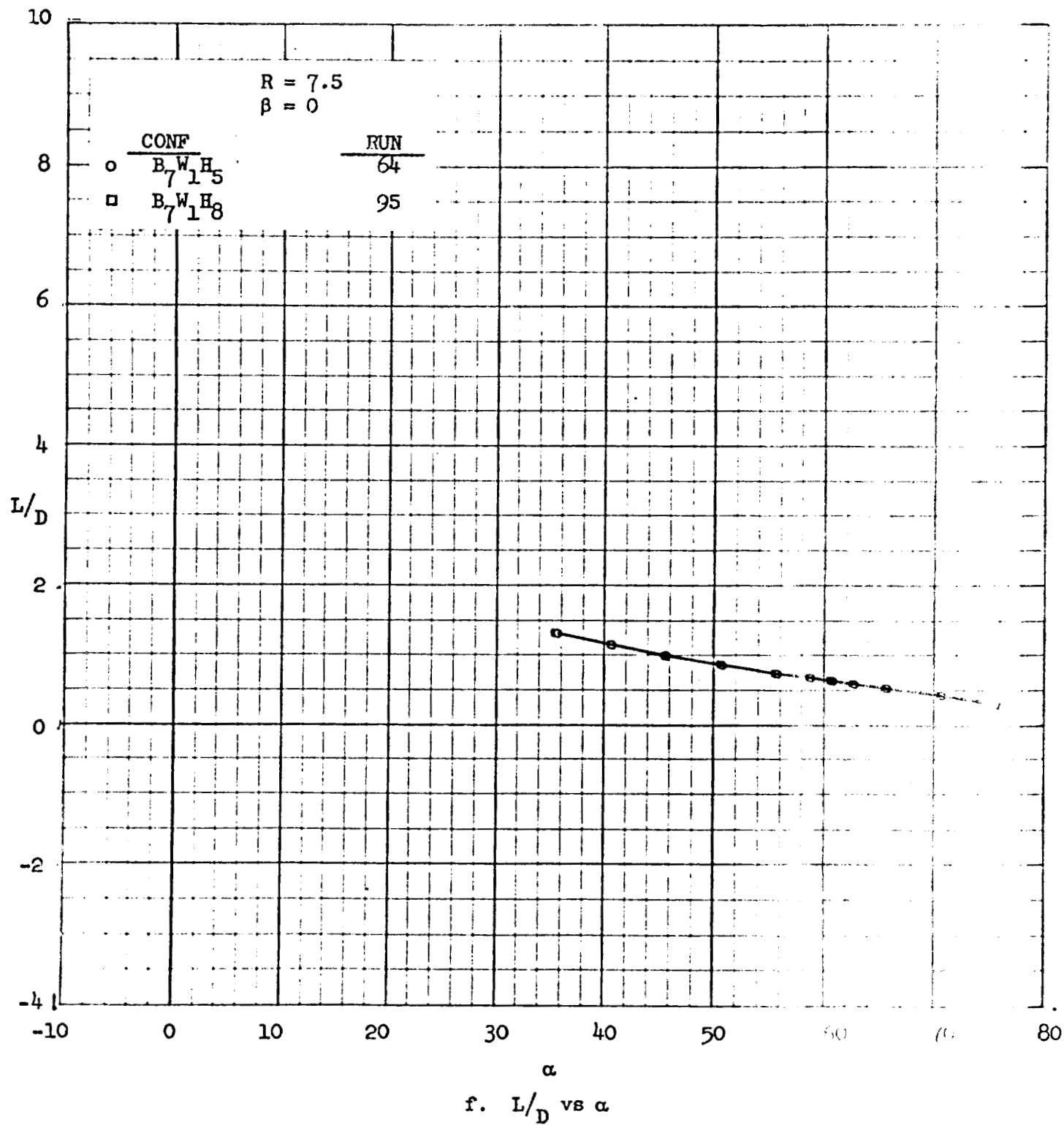
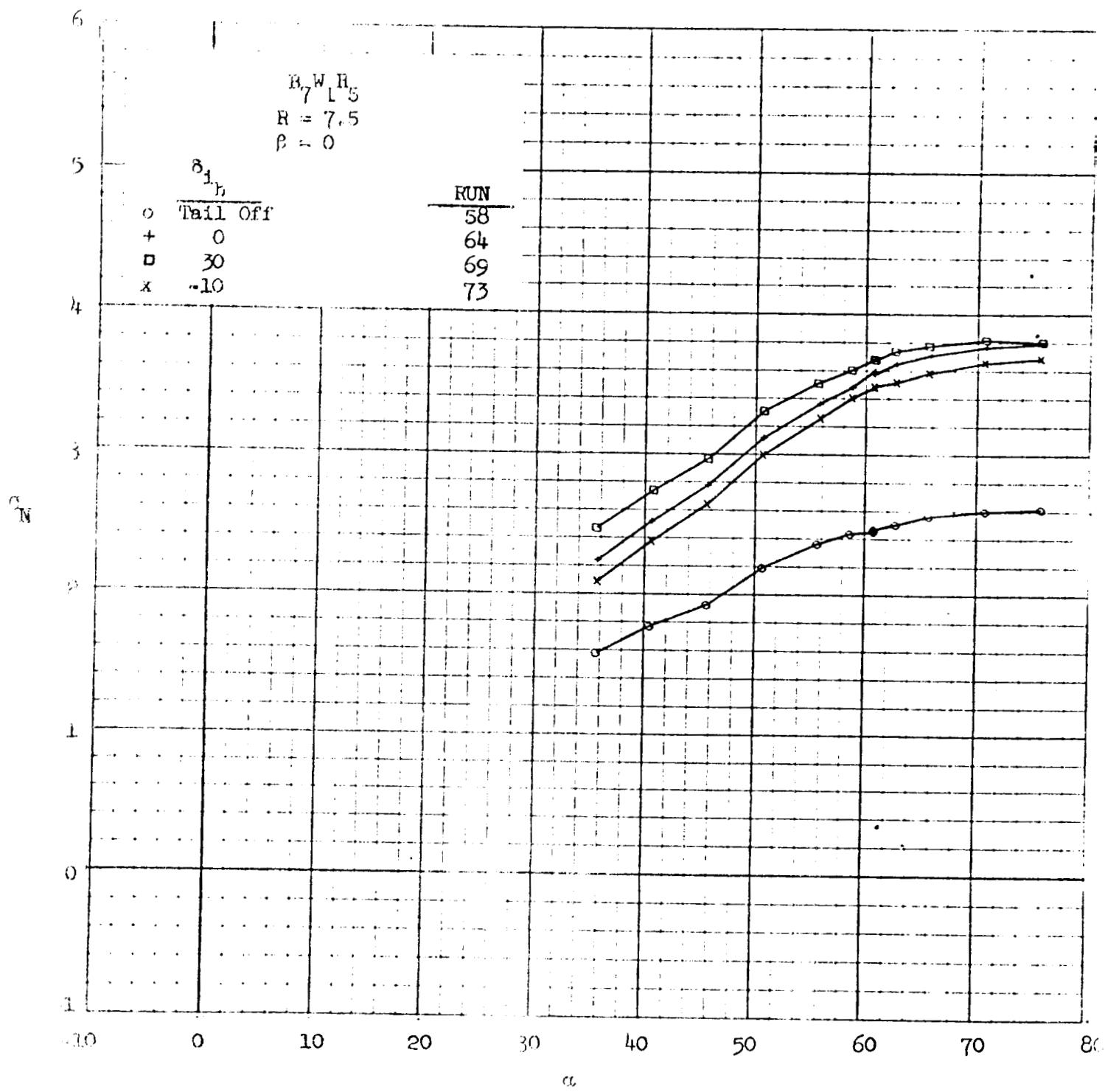


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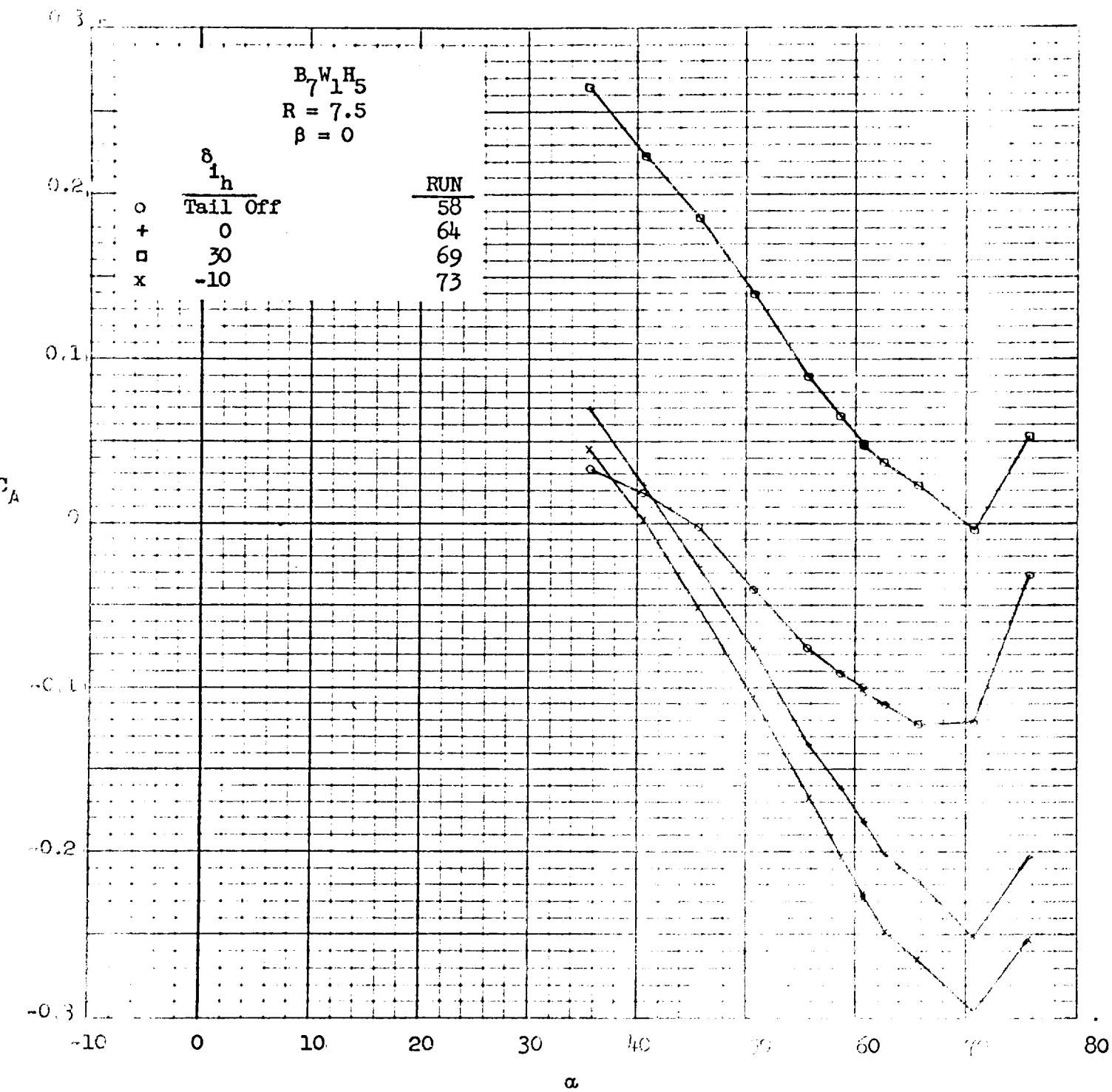


$$\alpha \quad C_N \quad \alpha$$

Figure 28. - Effect of angle of attack on longitudinal characteristics for various elevator deflection angles, $B_7 W_1 H_5$, $R = 7.5$.

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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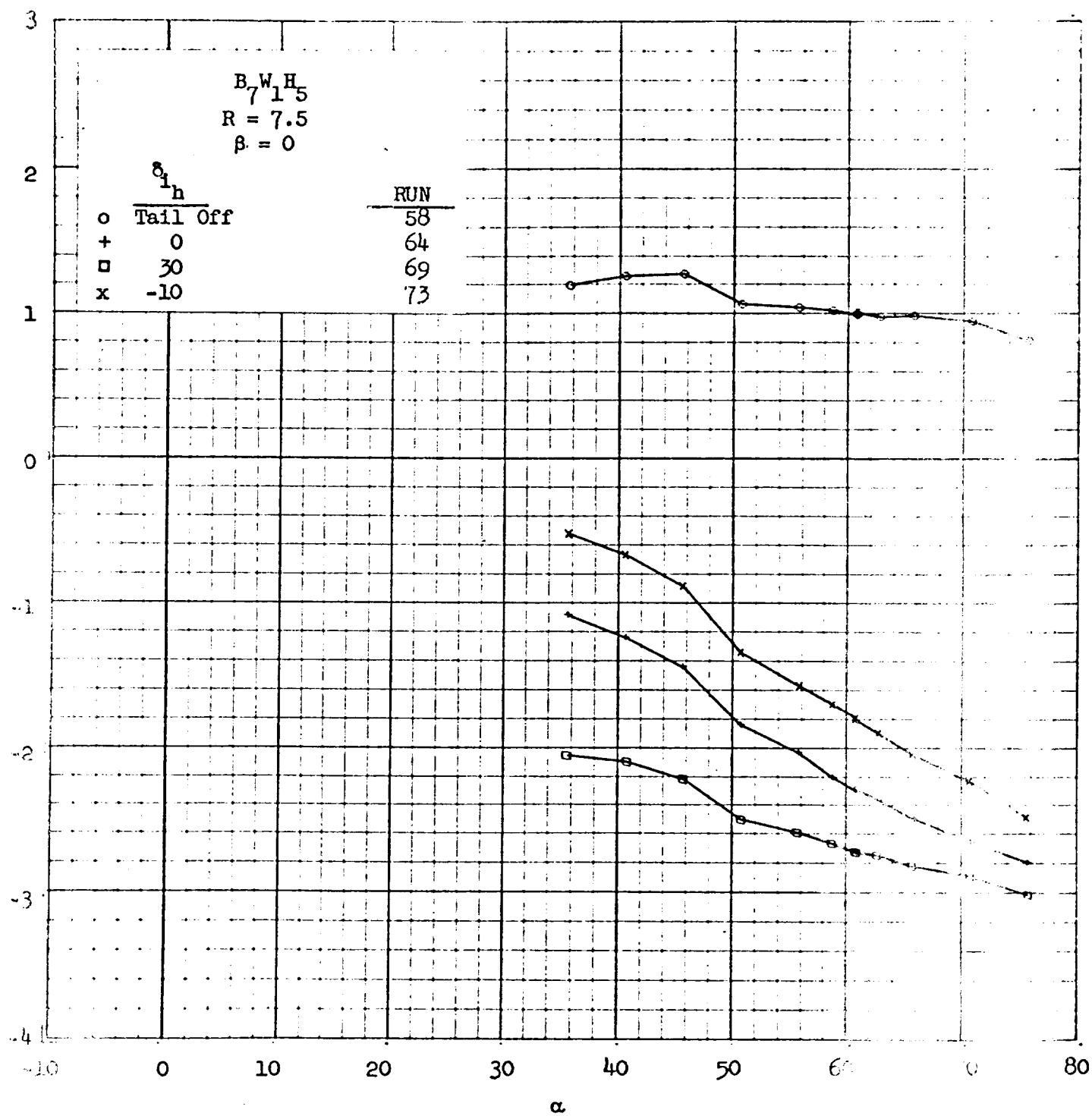


b. C_A vs α

Figure 28. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



c. C_m vs α

Figure 28. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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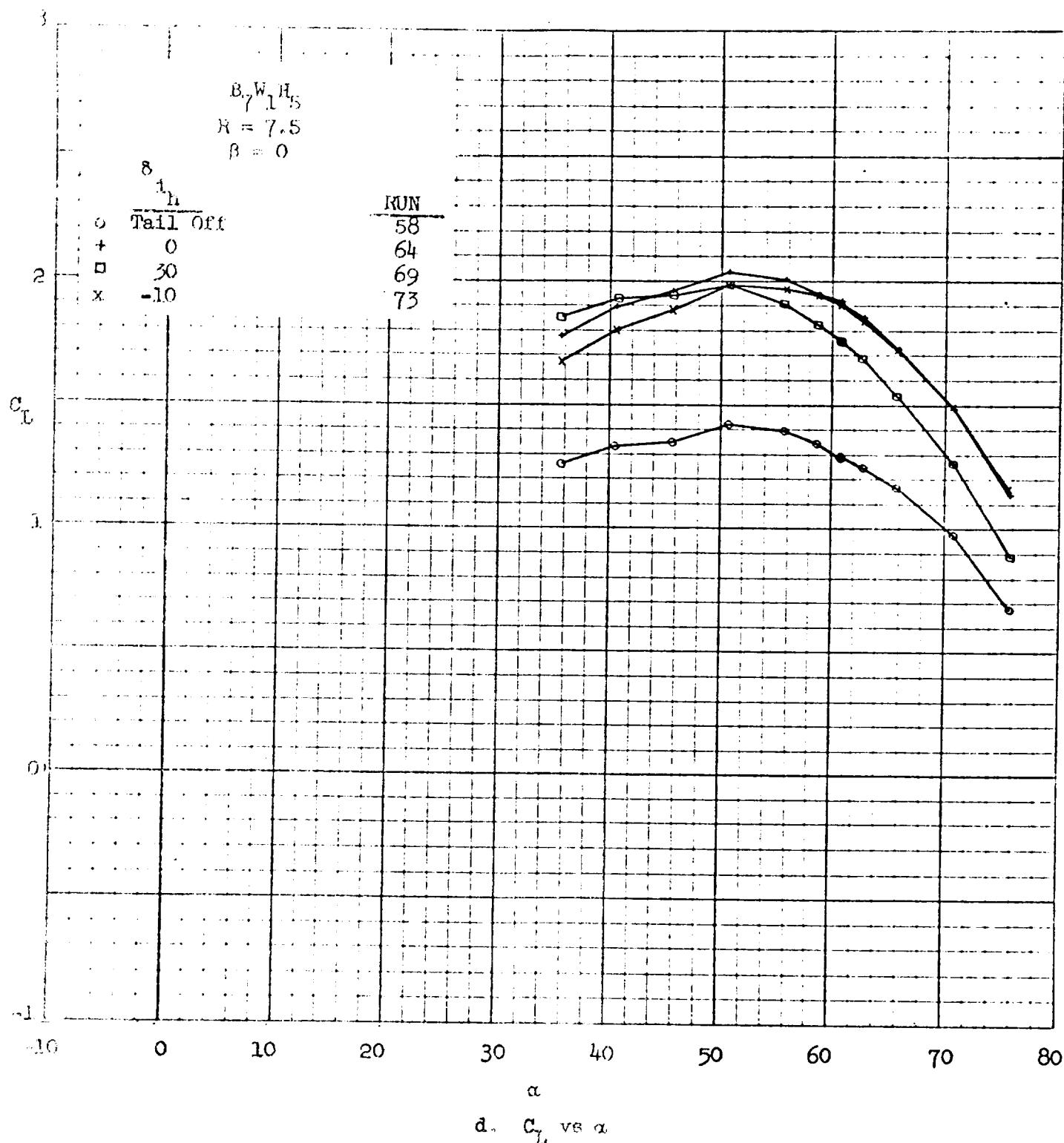


Figure 23. - Continued

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Ames Research Center: MOFFETT FIELD, CALIF.

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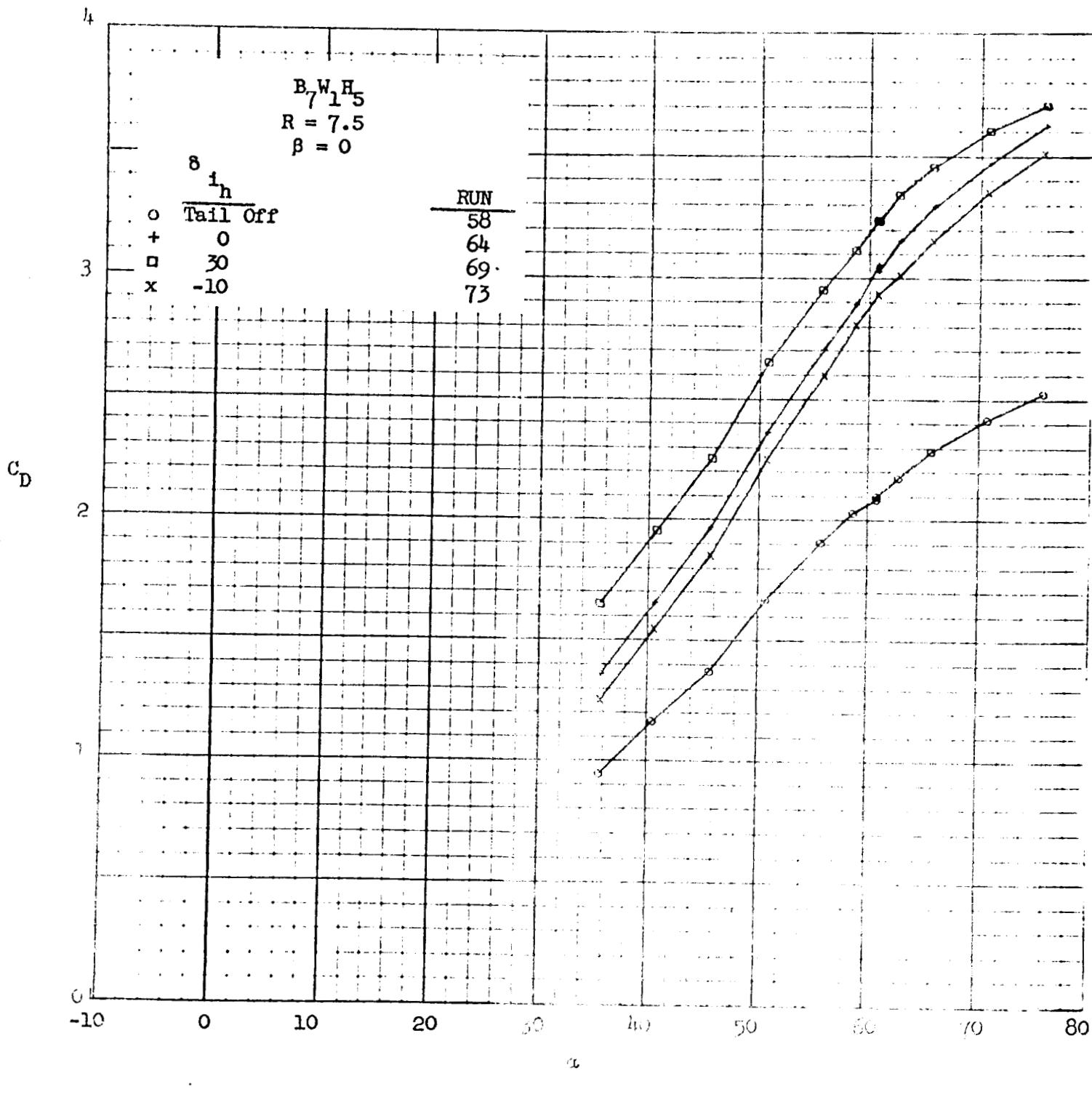


Figure 28. - continued

National Aeronautics and Space Administration
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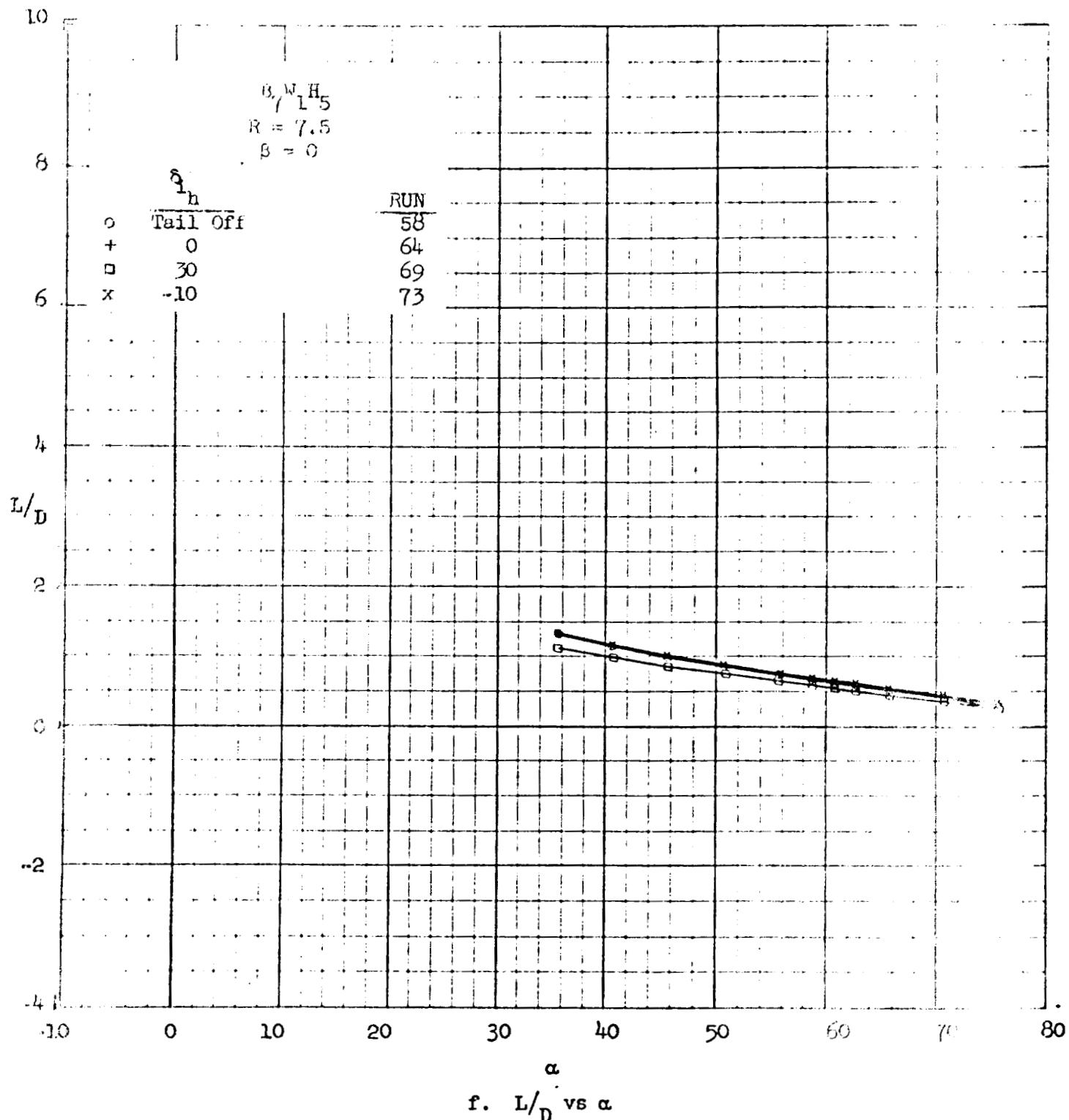


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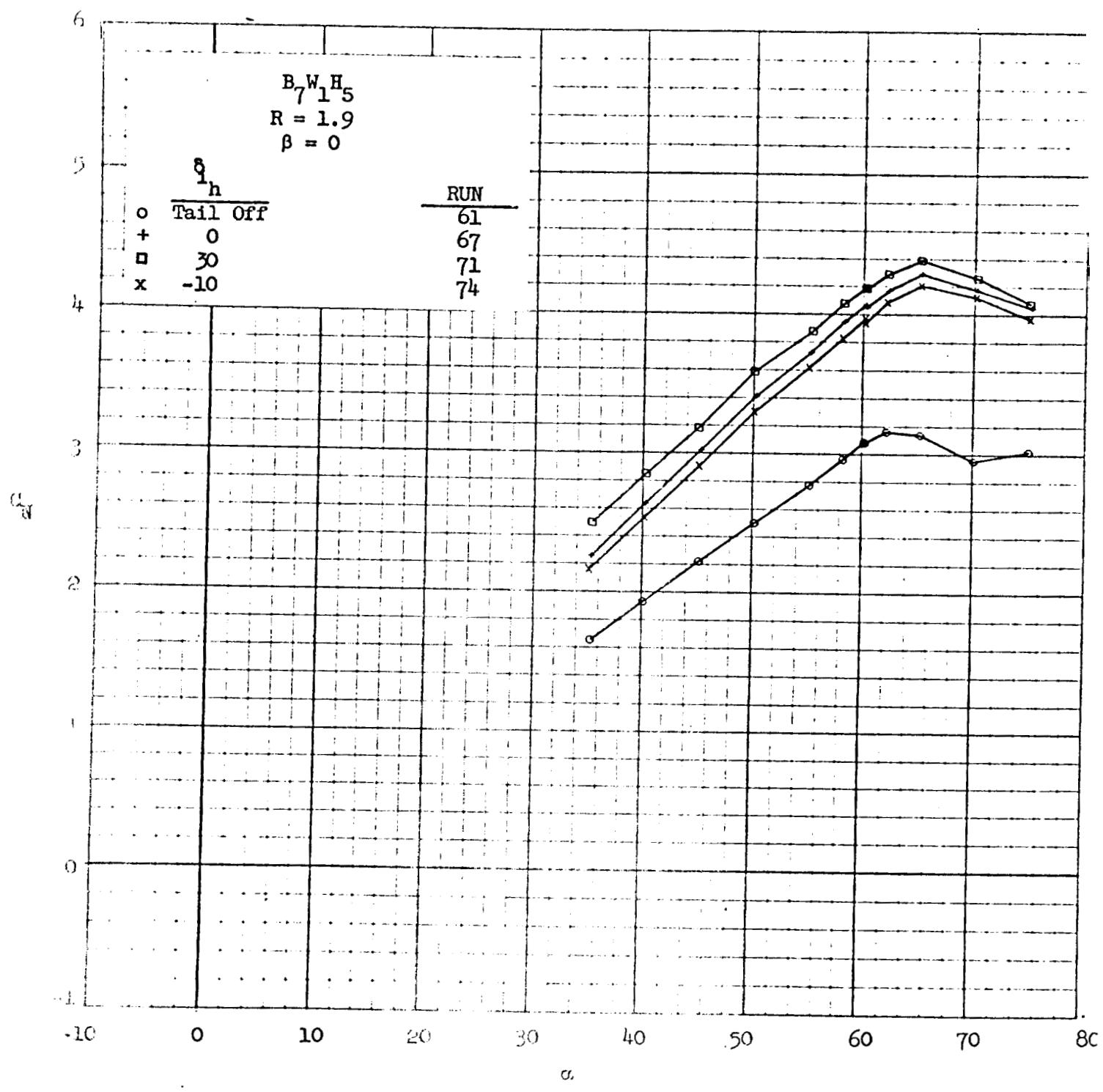
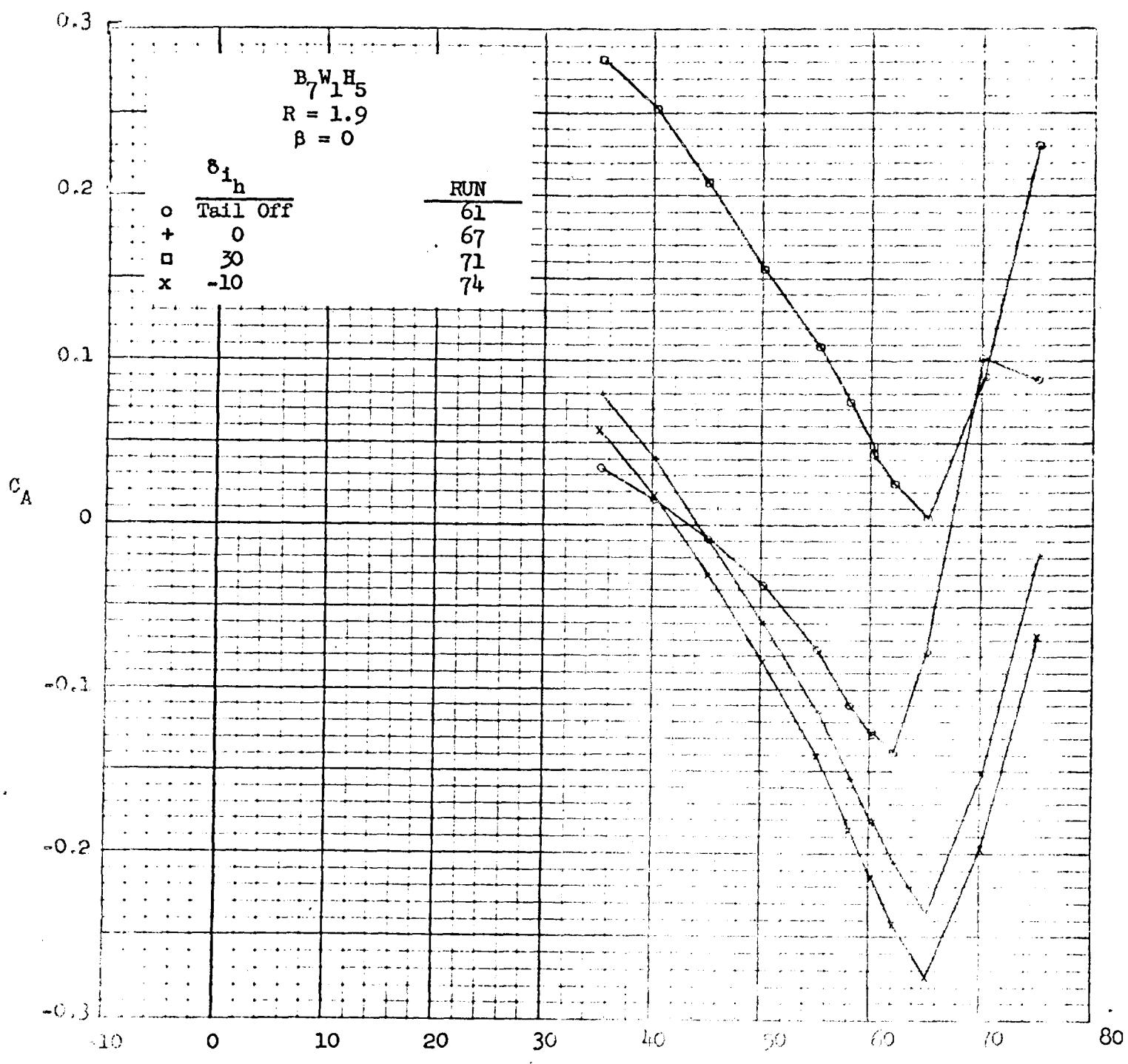


Figure 29. - Effect of angle of attack on longitudinal characteristics for various elevator deflection angles, $B_7W_1H_5$, $R = 1.9$.

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



b. C_A vs α

Figure 29. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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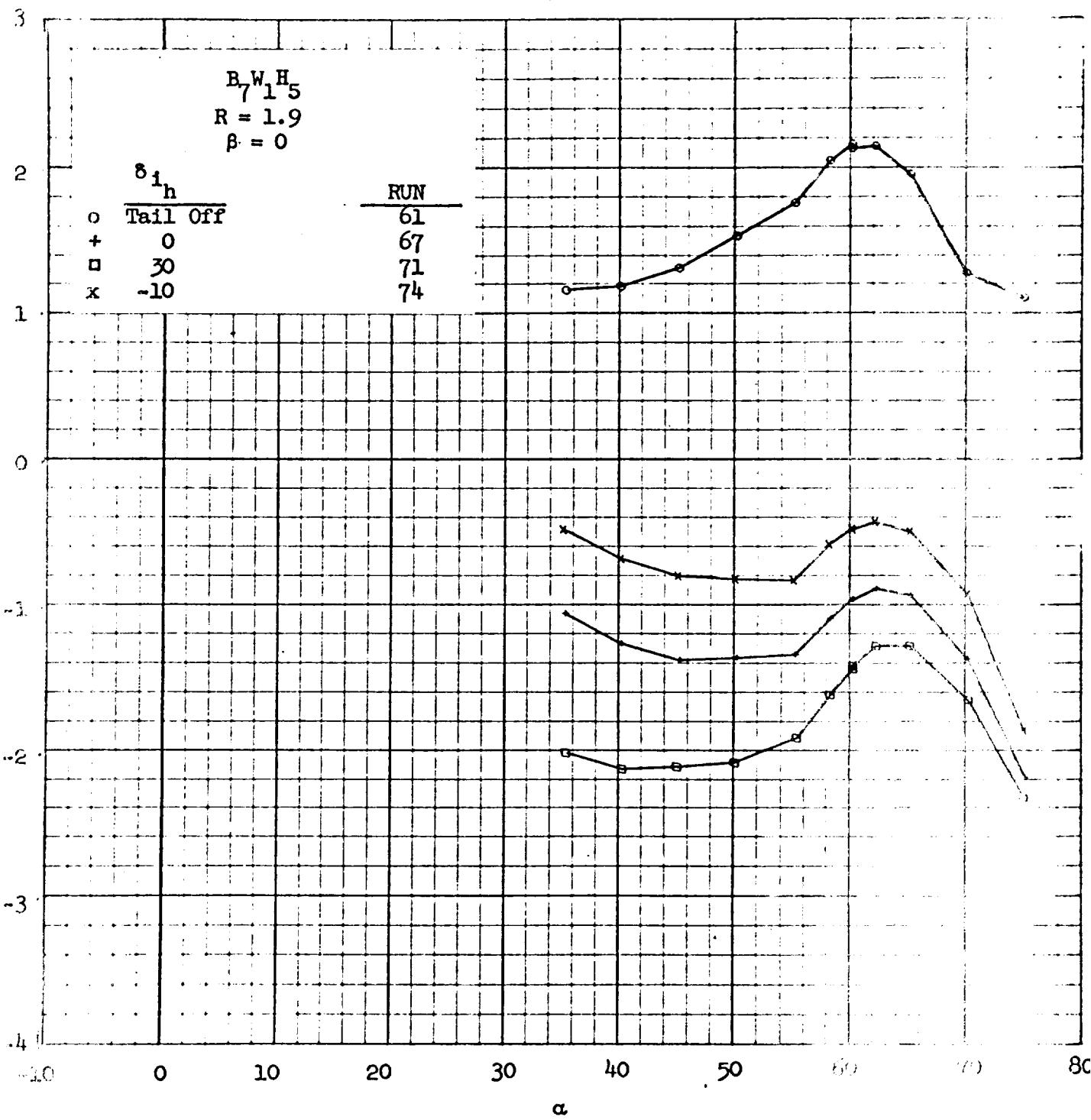


Figure 29. - continued

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Ames Research Center: MOFFETT FIELD, CALIF.

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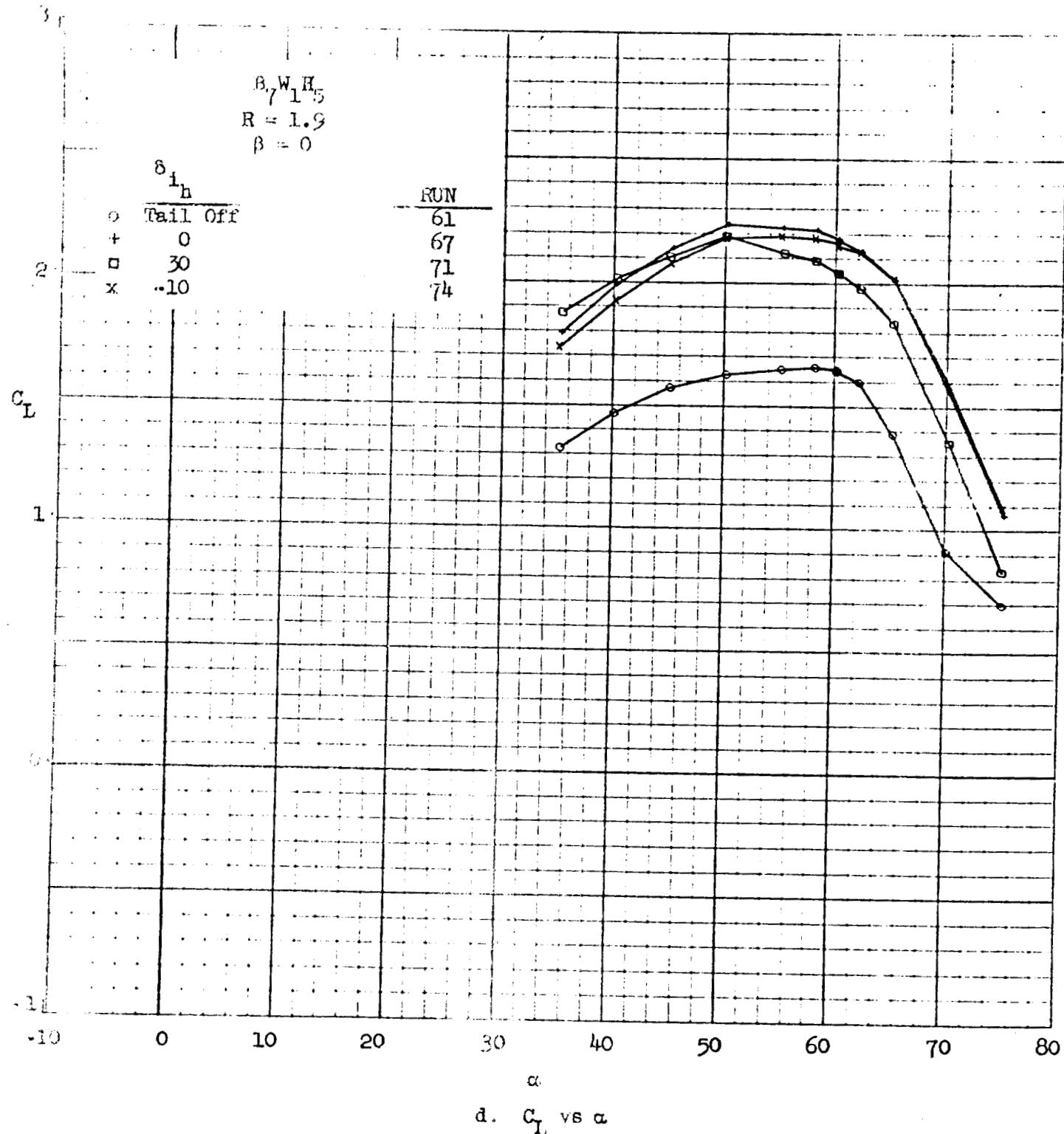
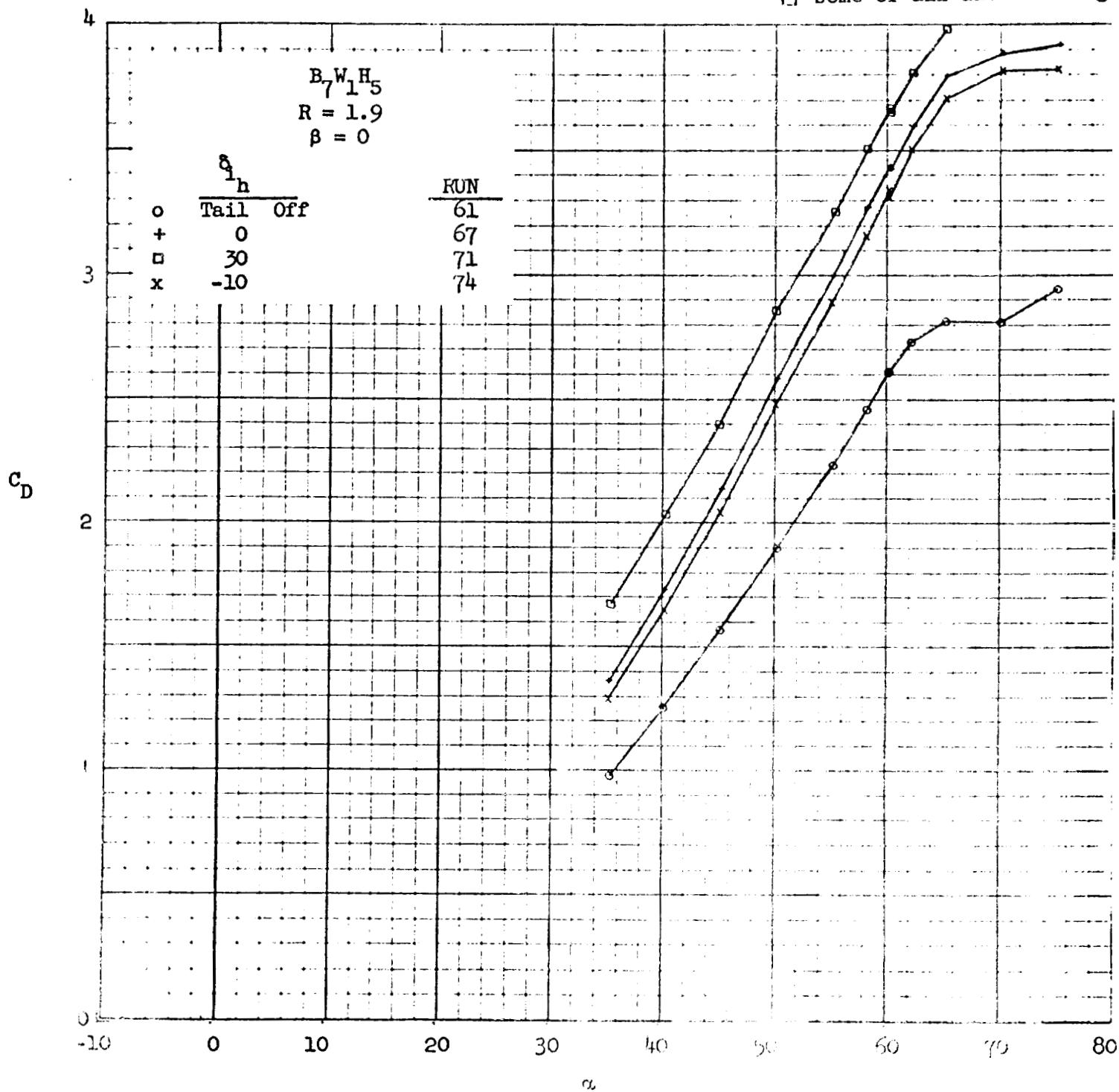


Figure 29 - Continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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e. C_D vs α

Figure 29. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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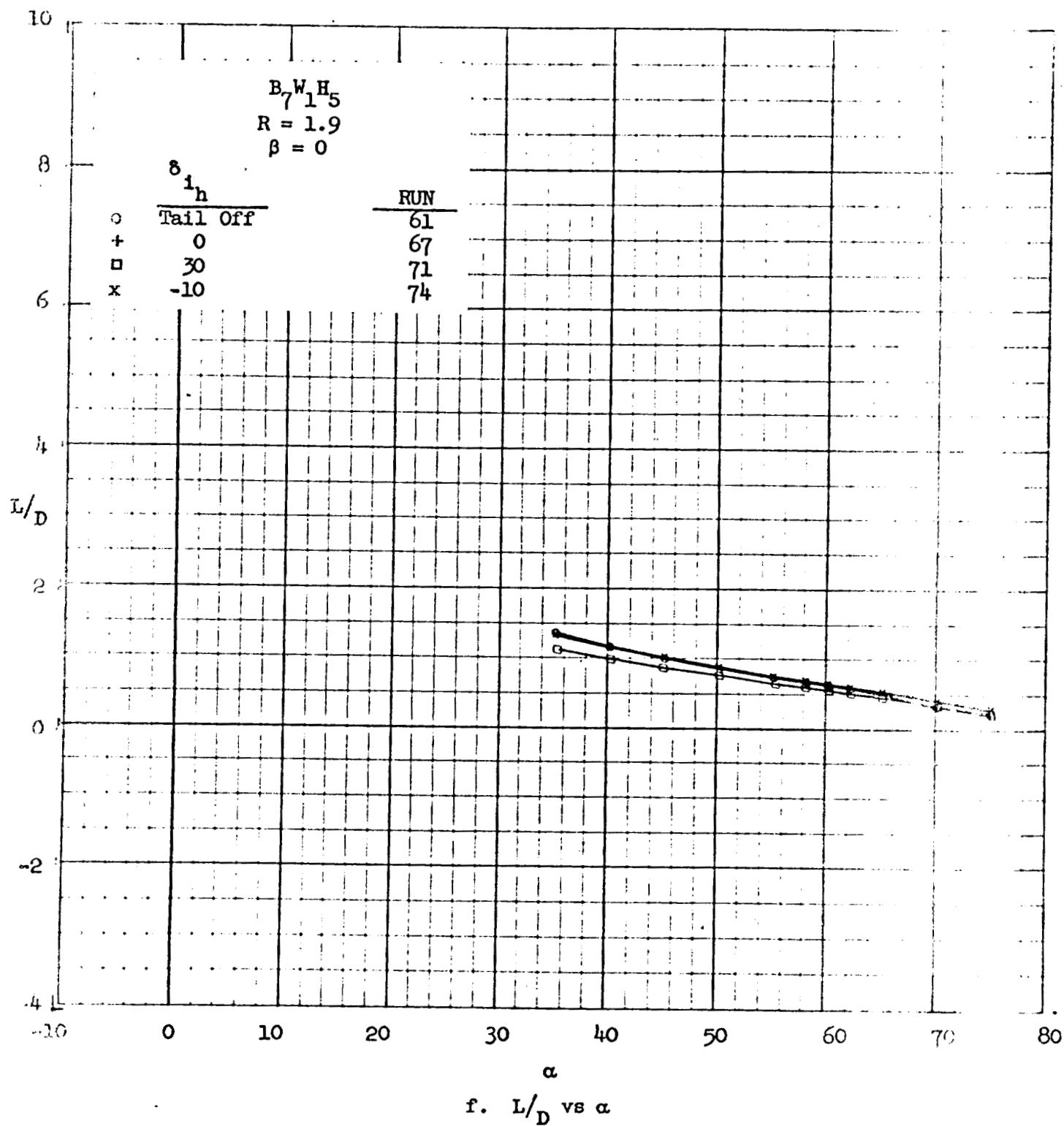
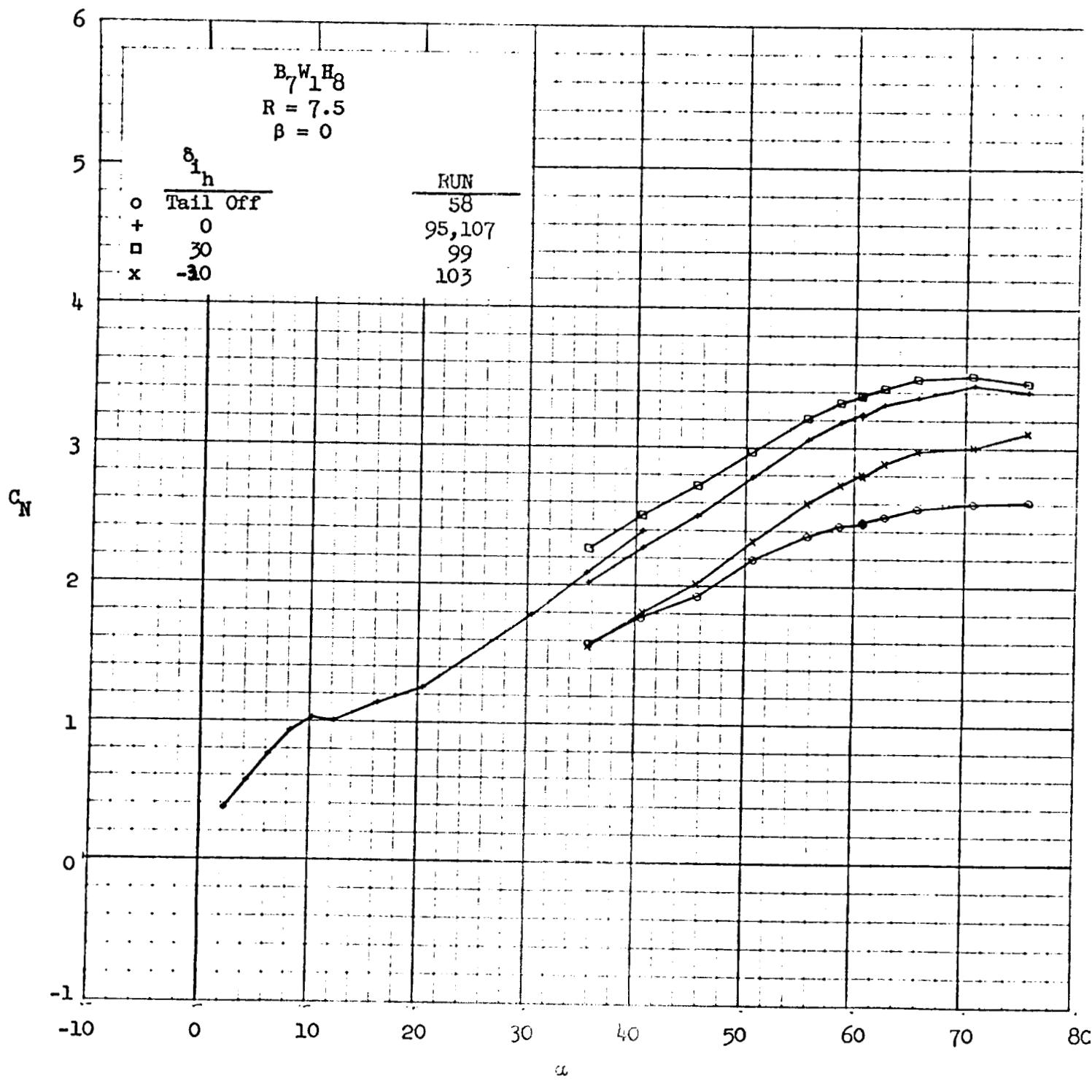


Figure 29. - Concluded

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



a. C_N vs. α

Figure 30. - Effect of angle of attack on longitudinal characteristics for various elevator deflection angles, $B_7W_1H_8$, $R = 7.5$.

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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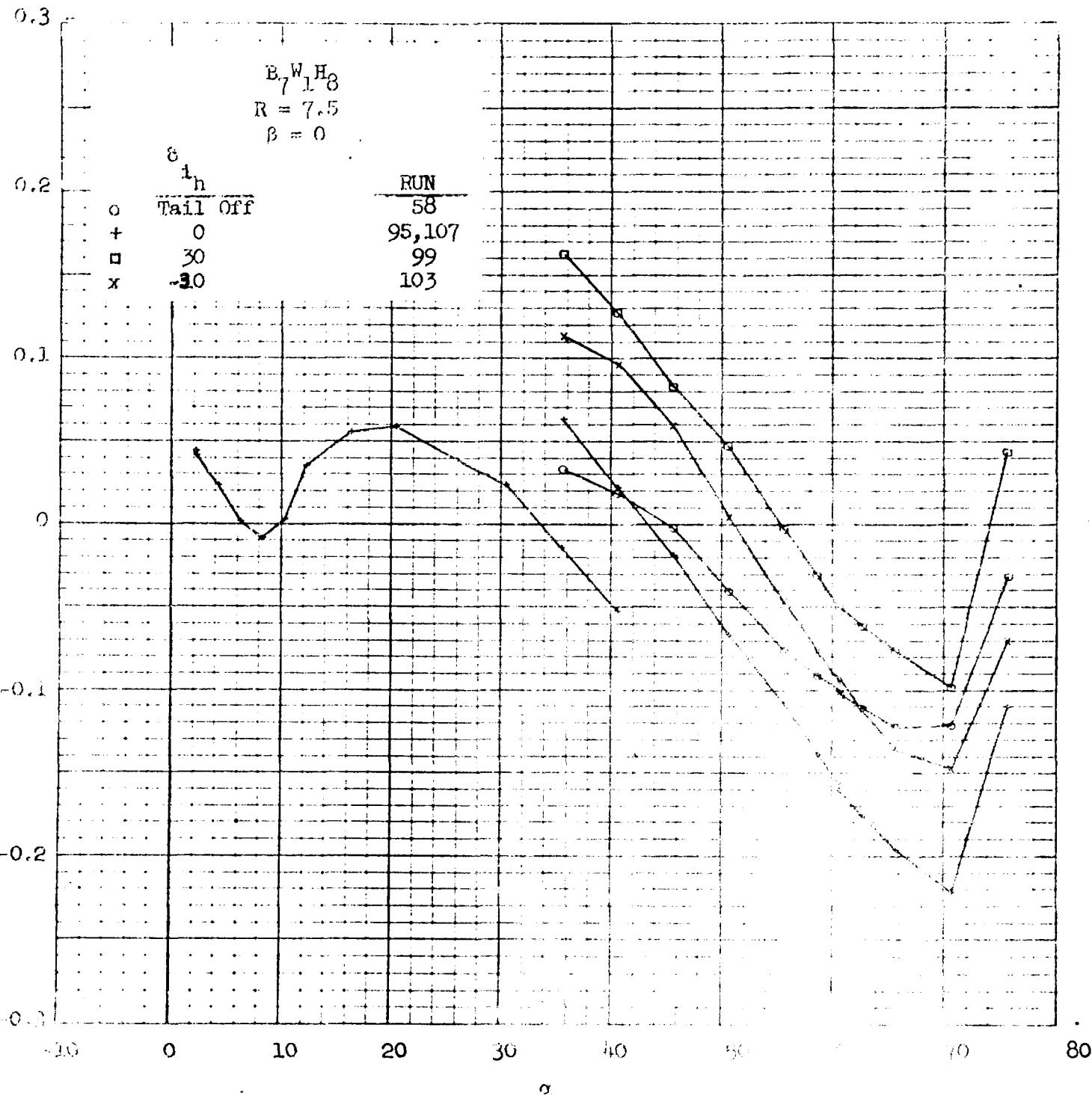
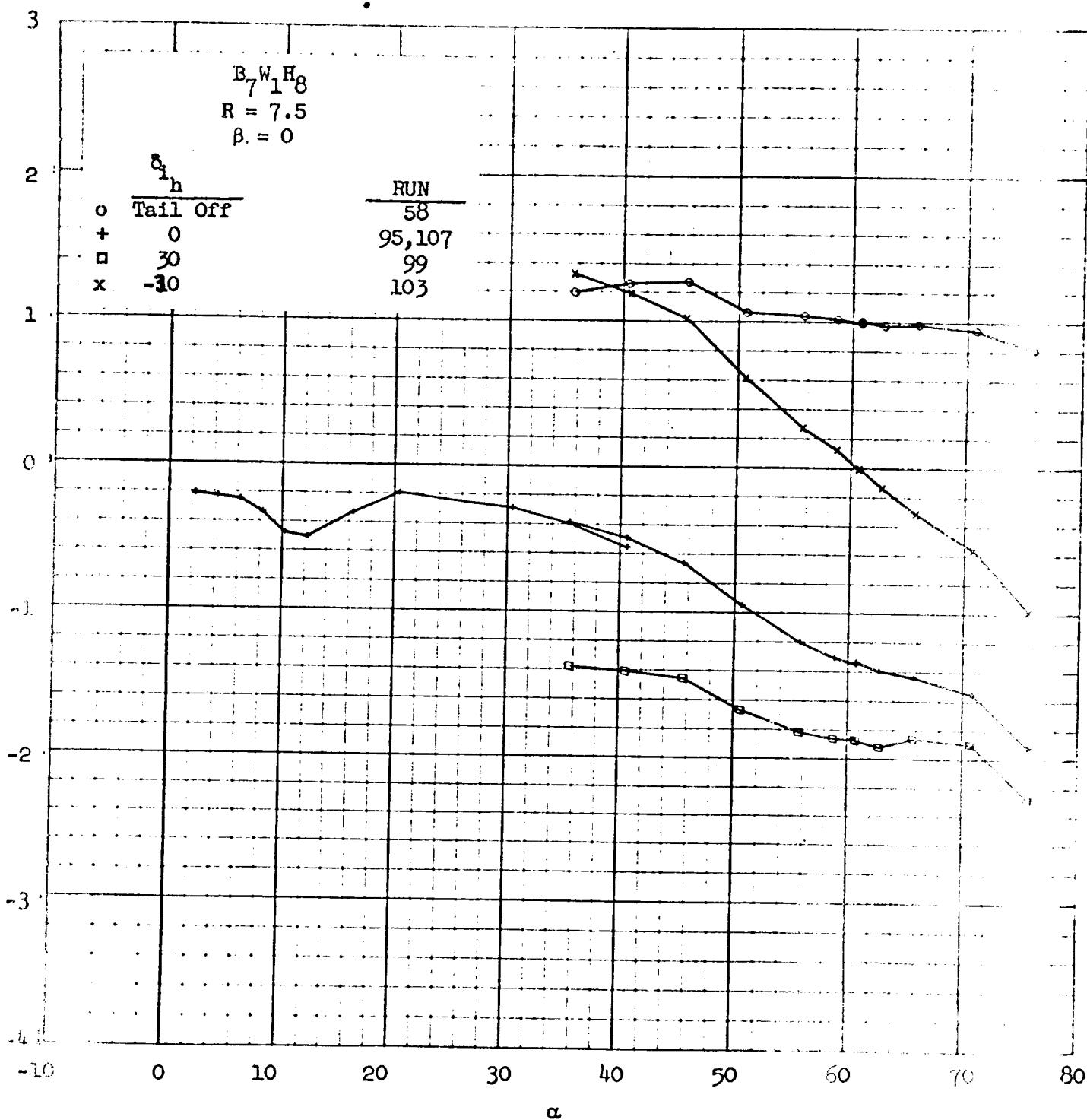


Figure 50. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



c. C_m vs α

Figure 30. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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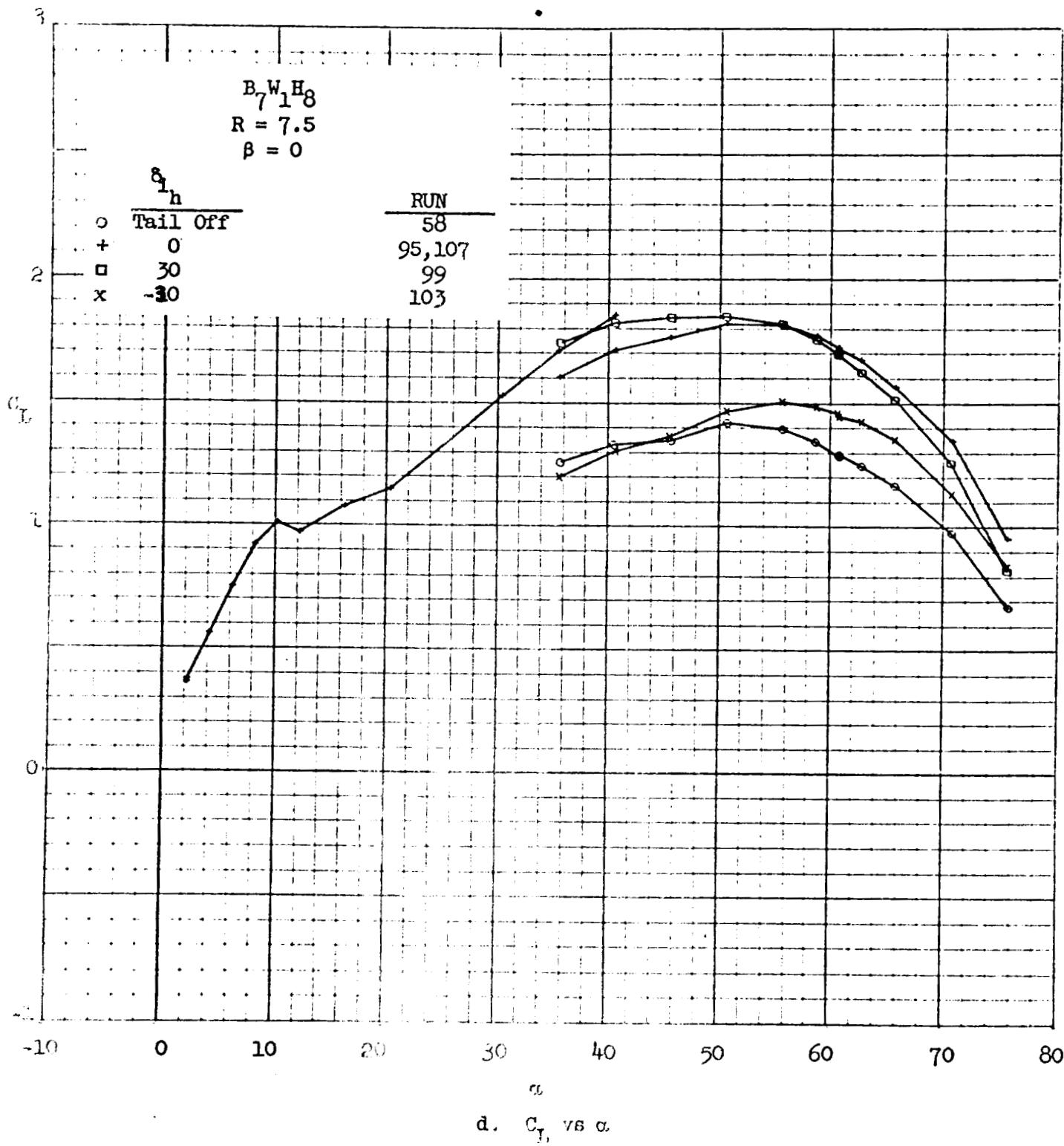
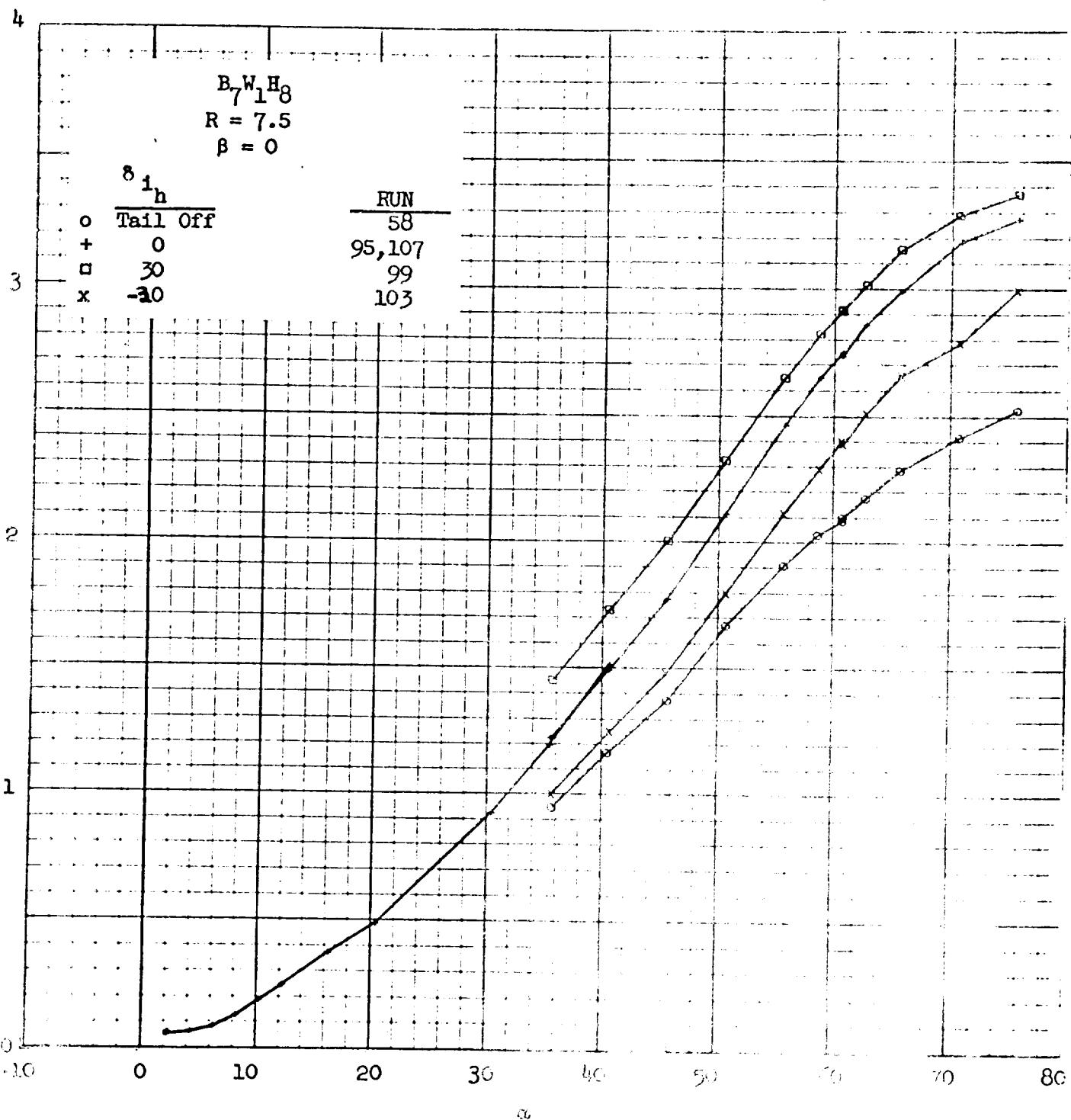


Figure 30 . - Continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



e. C_D vs α

Figure 30. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA

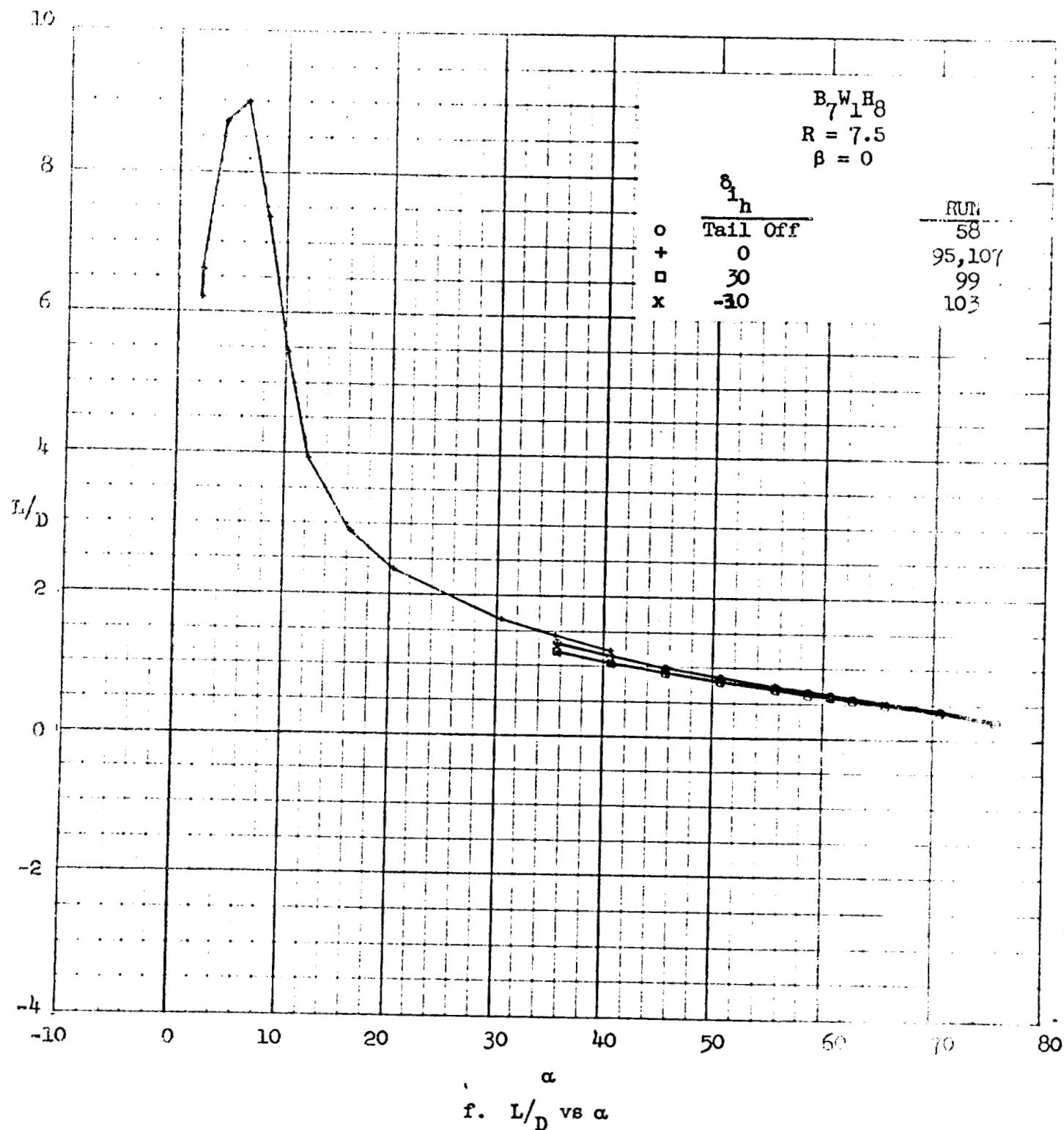


Figure 30. - Concluded

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA

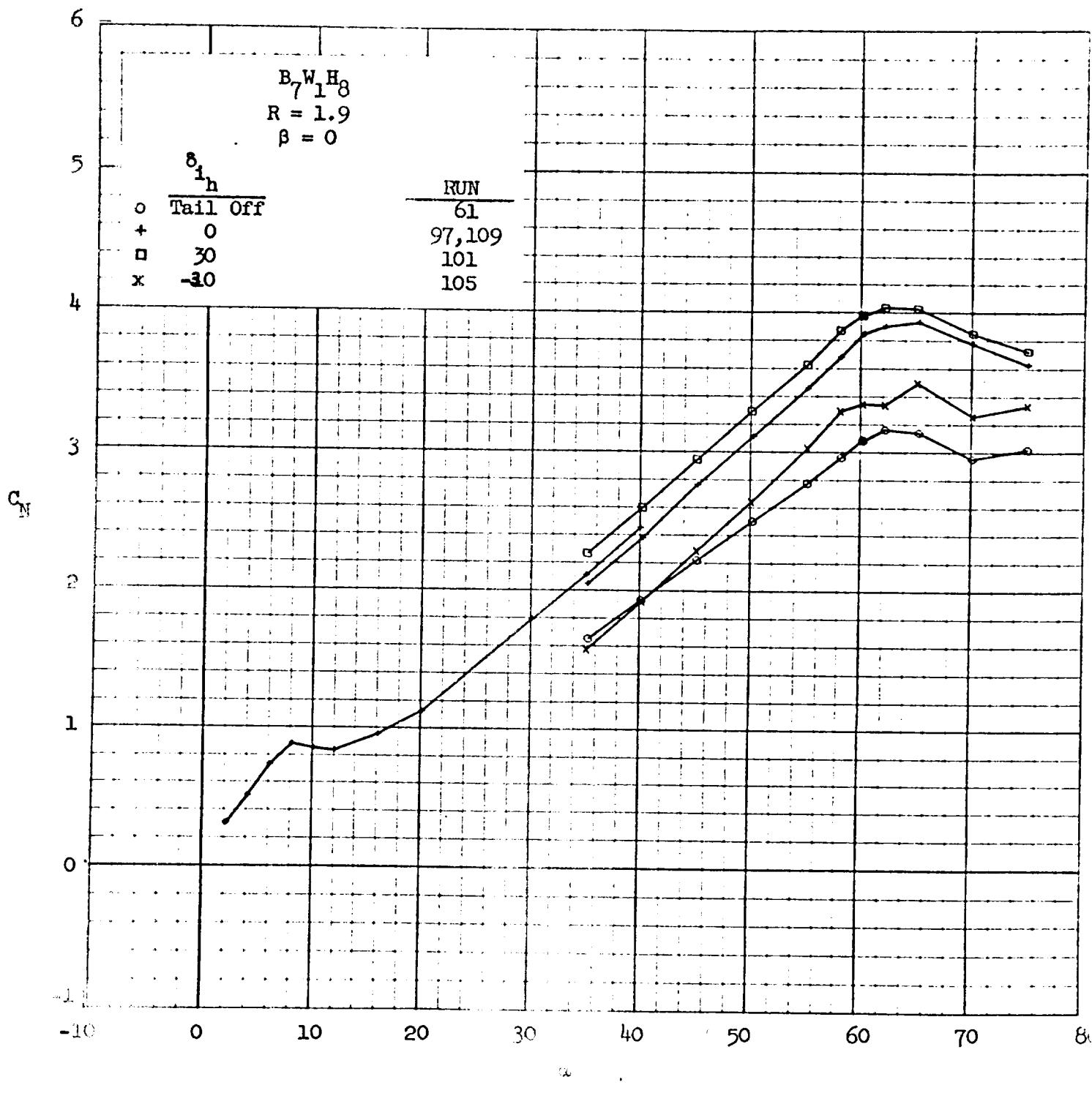
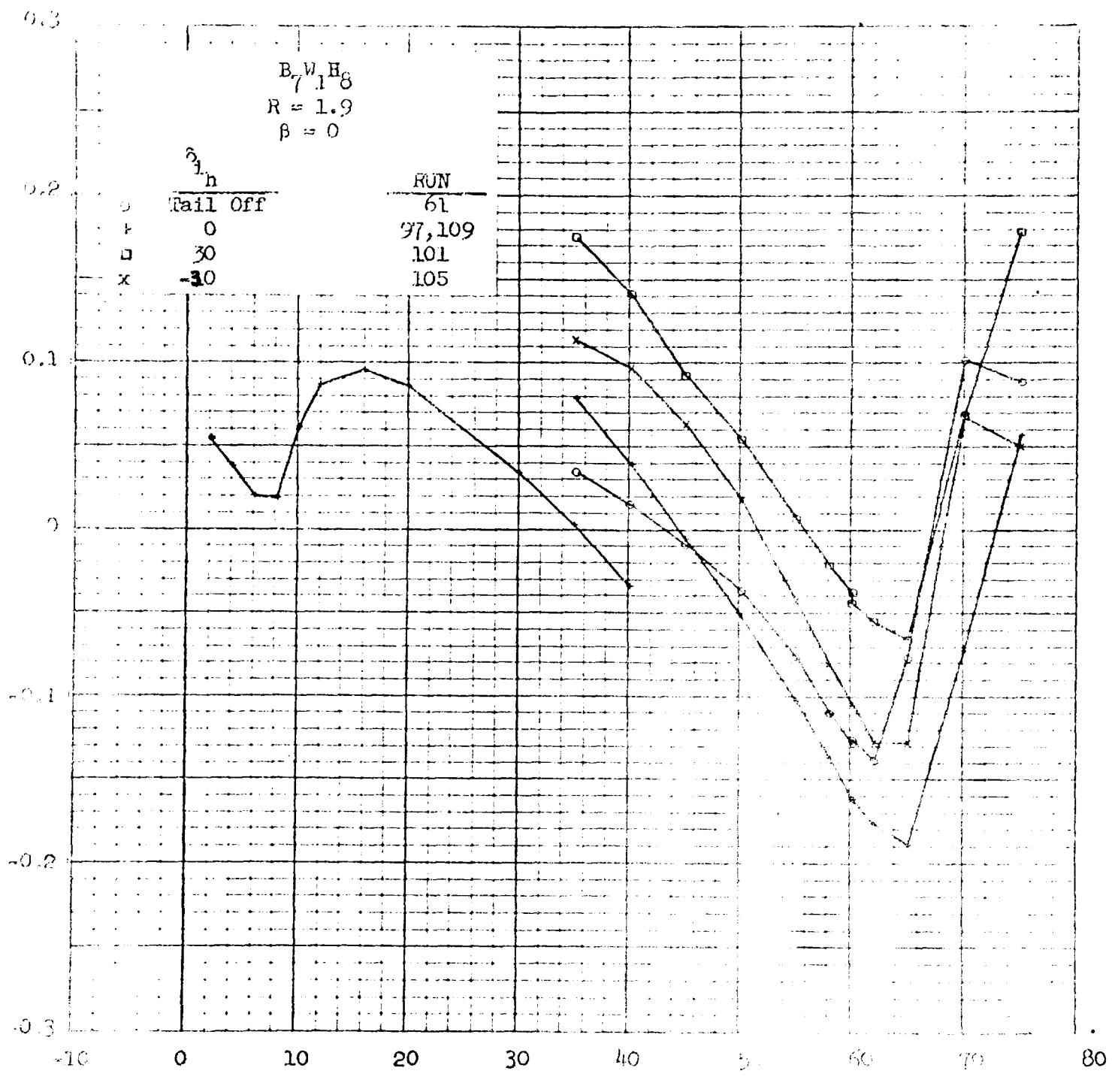


Figure 31. - Effect of angle of attack on longitudinal characteristics for various elevator deflection angles, $B_7W_1H_8$, $R = 1.9$.

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA

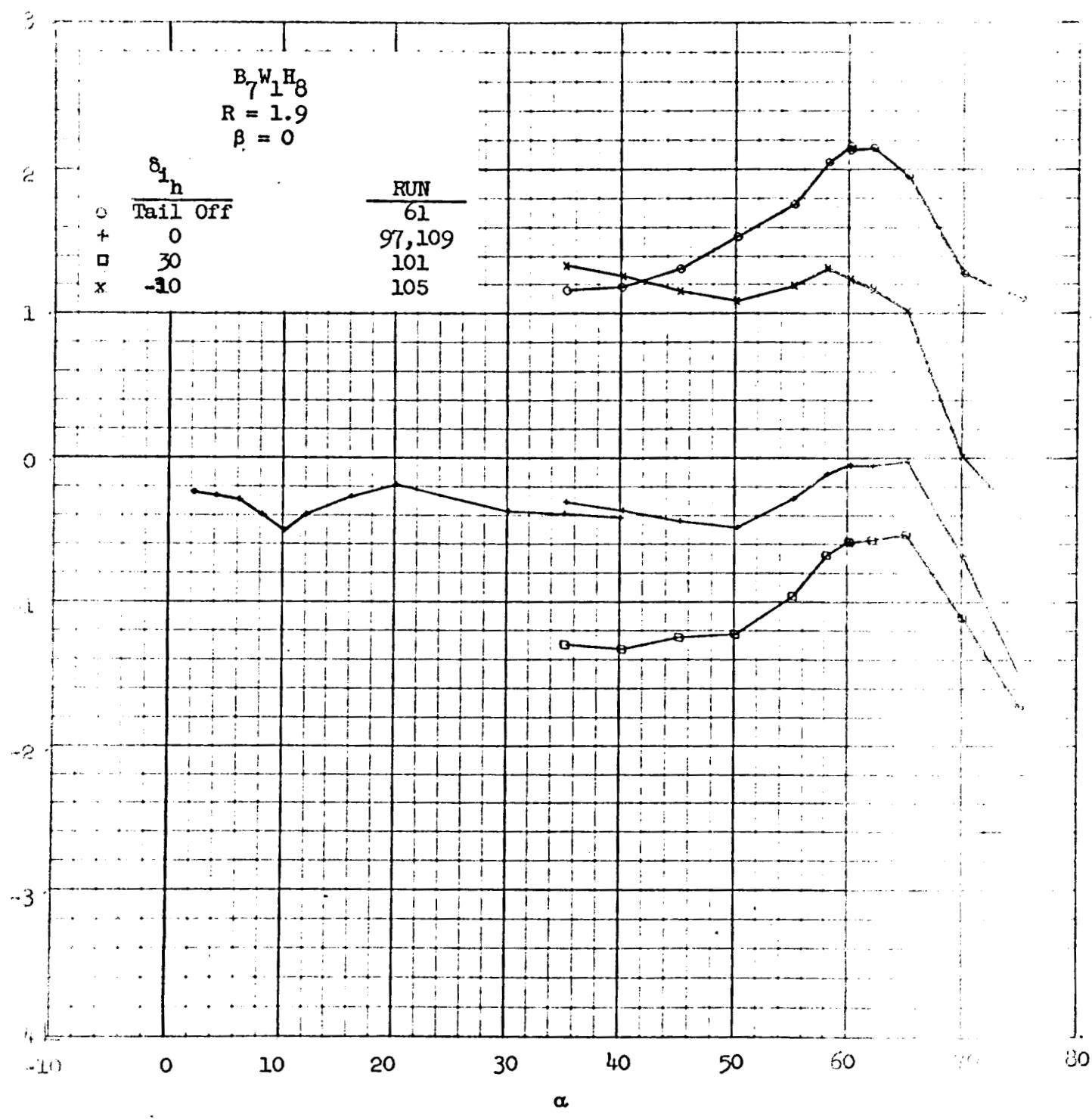


b. C_d vs α .

Figure 31. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



c. C_m vs α

Figure 31. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA

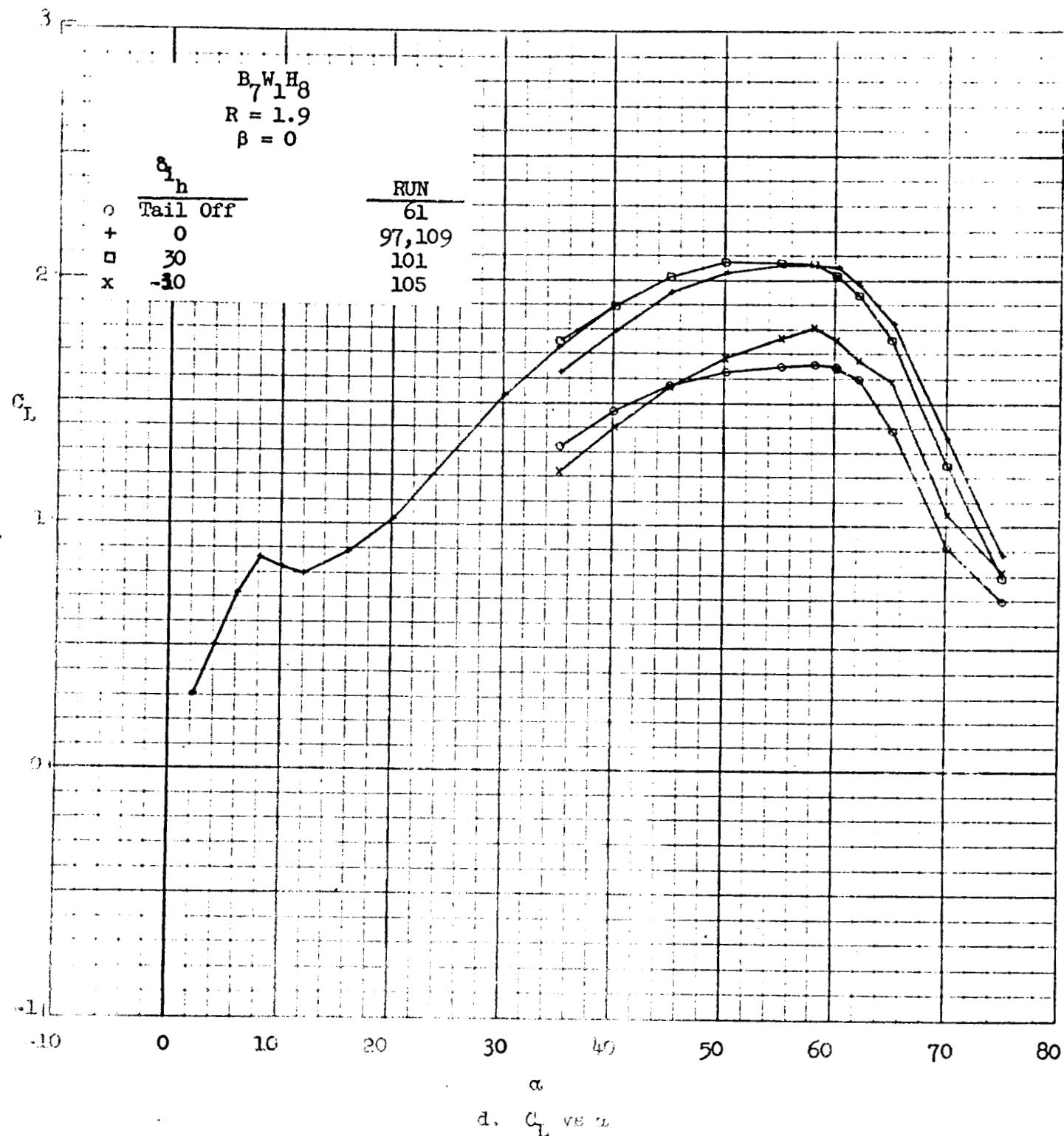
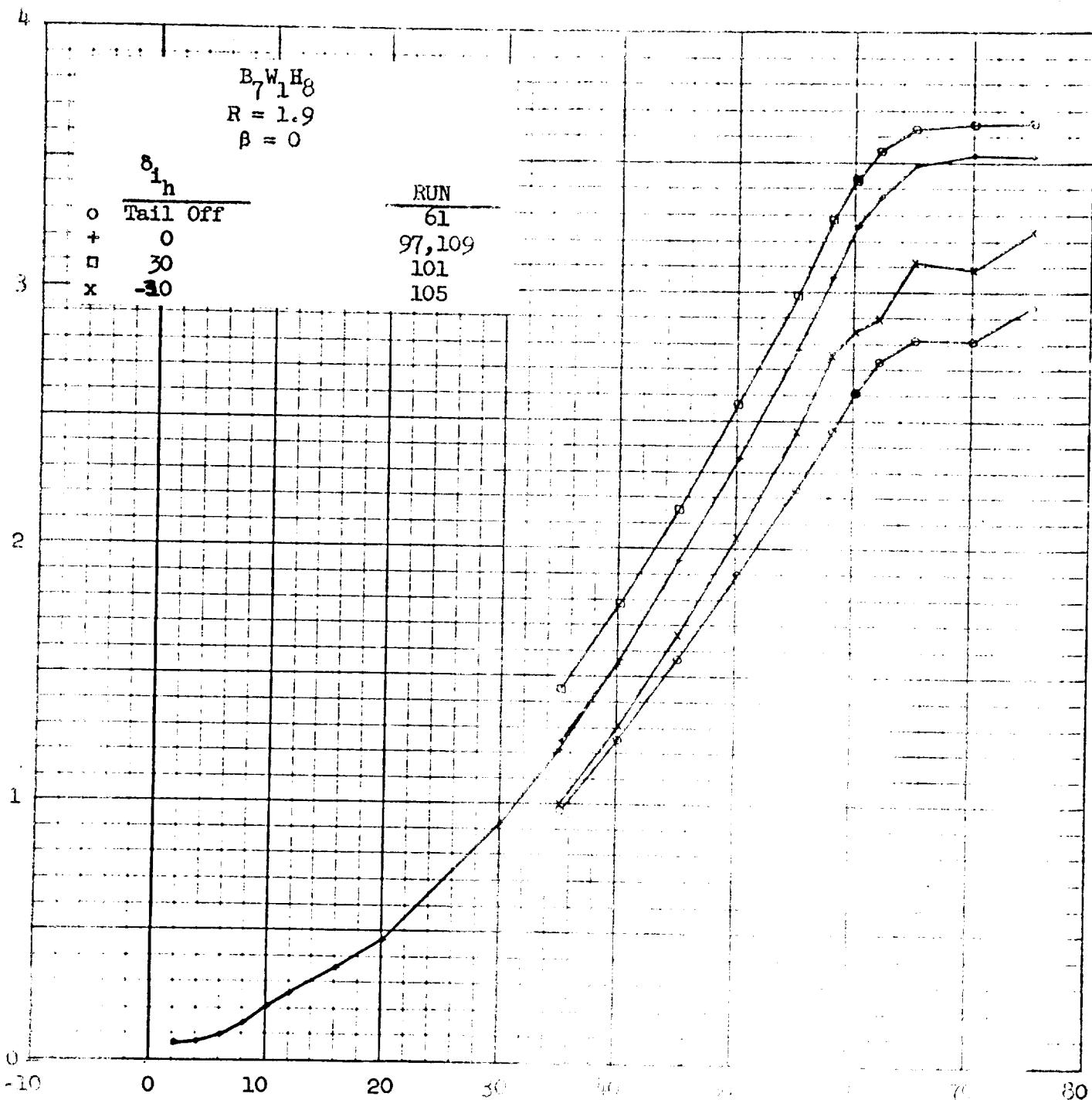


Figure 31. - Continued.

National Aeronautics and Space Administration
Ames Research Center, MOFFETT FIELD, CALIF

PRELIMINARY DATA



e. C_D vs. α

Figure 31. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA

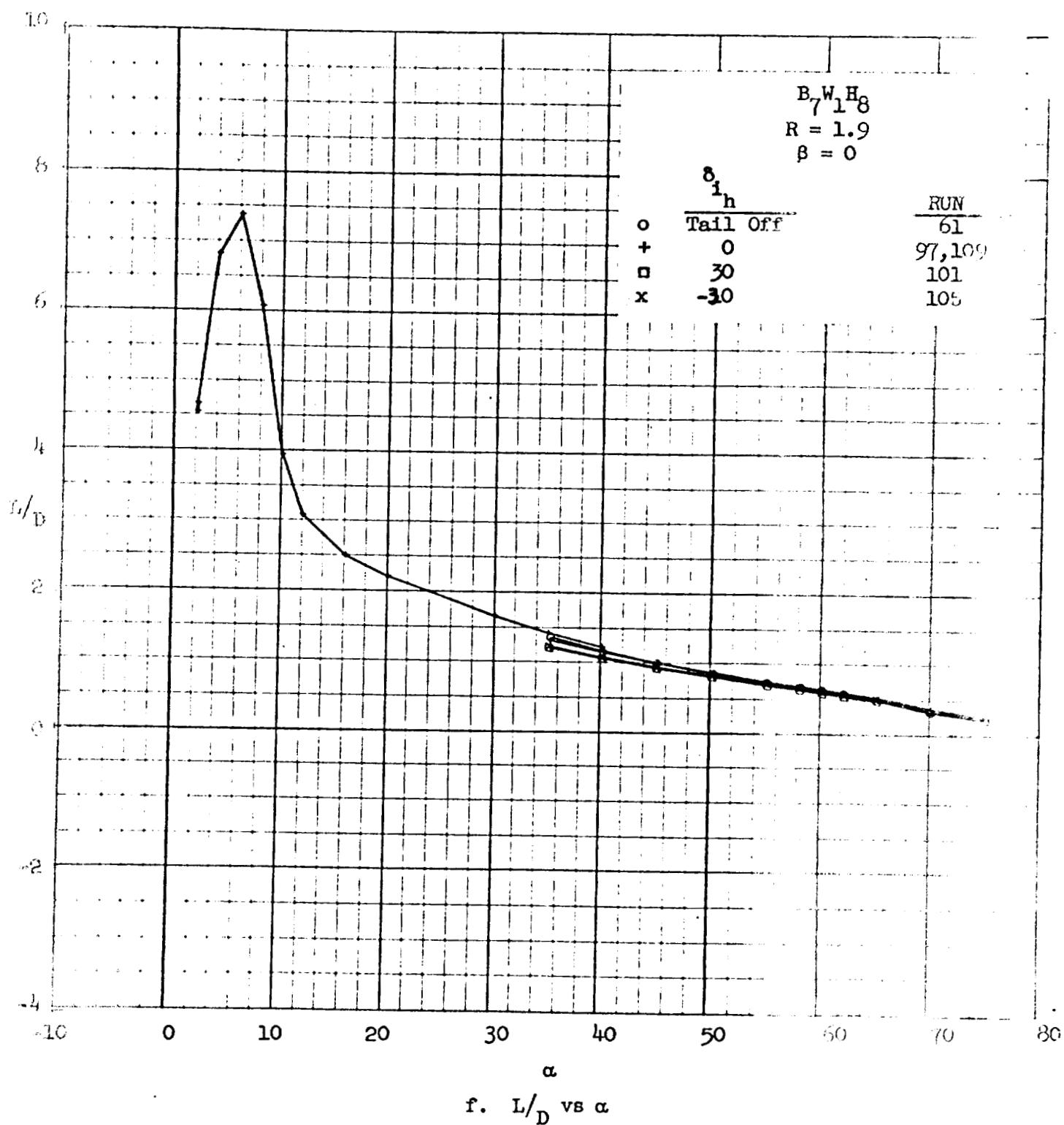
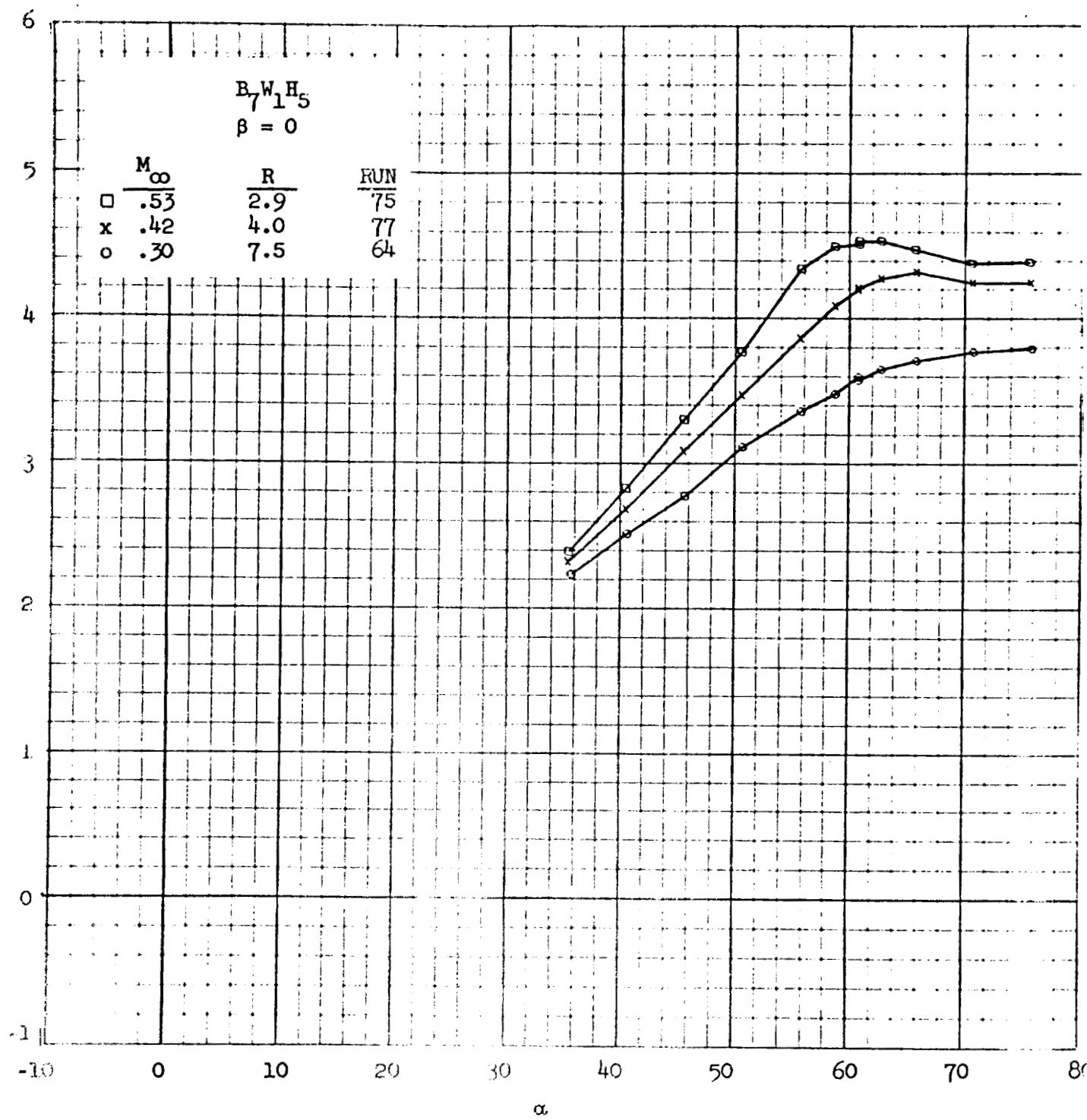


Figure 31. - Concluded

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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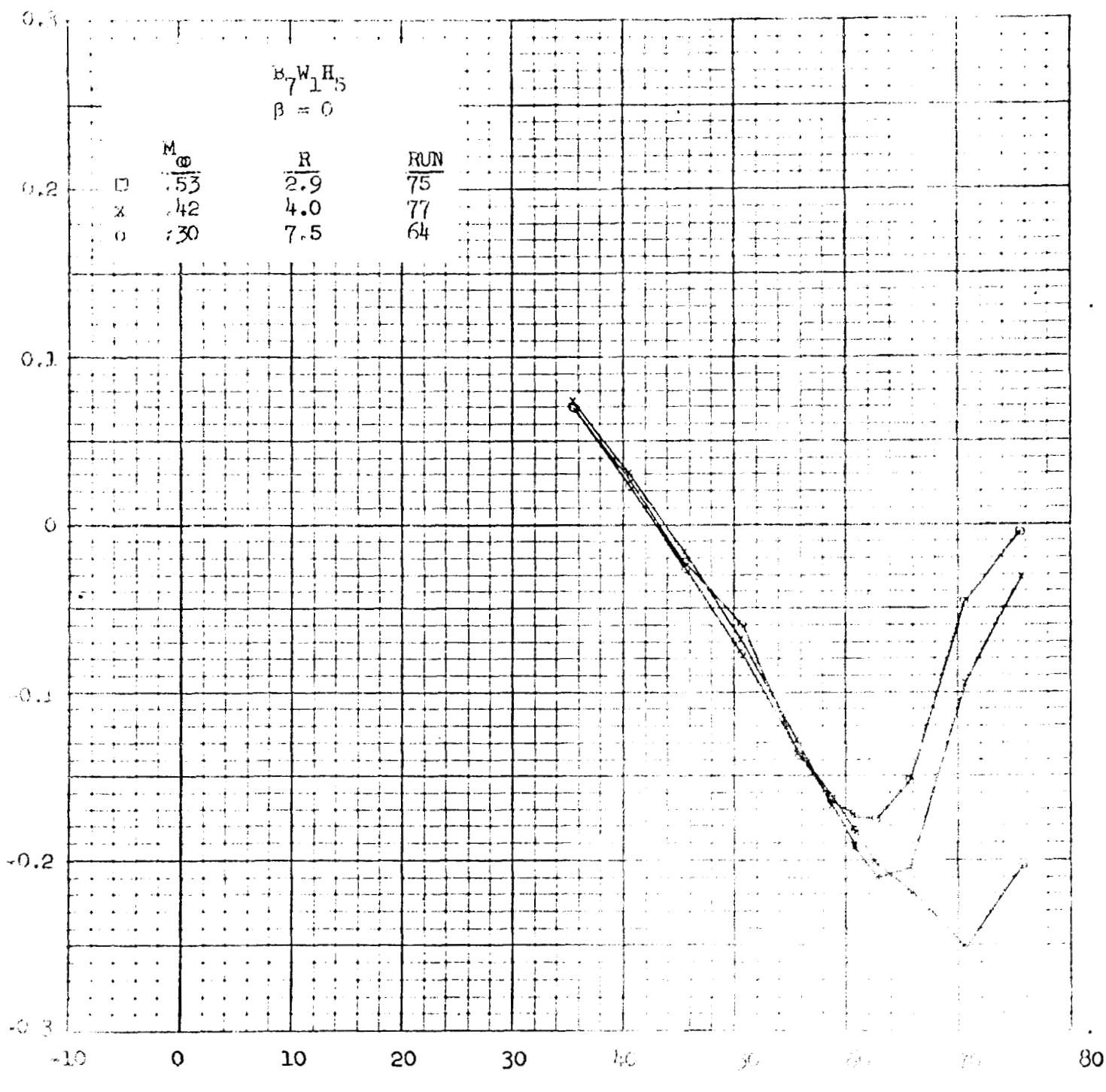


a. C_N vs α

Figure 32. - Variation of longitudinal characteristics with Mach number, $B_7 W_{1.5} H_5$.

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA

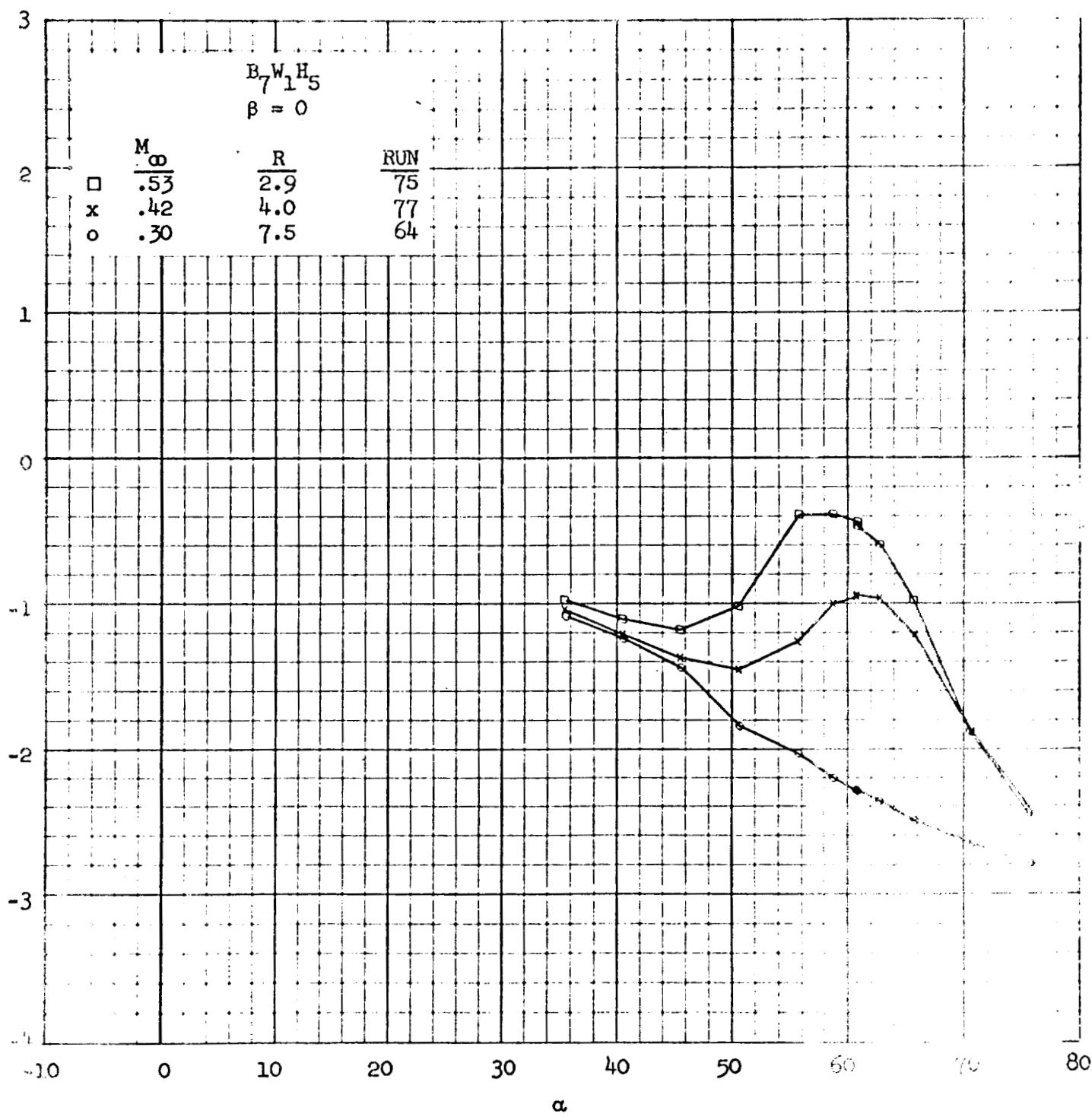


b. C_A vs α

Figure 32. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



c. C_m vs α

Figure 32. - continued

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Ames Research Center: MOFFETT FIELD, CALIF.

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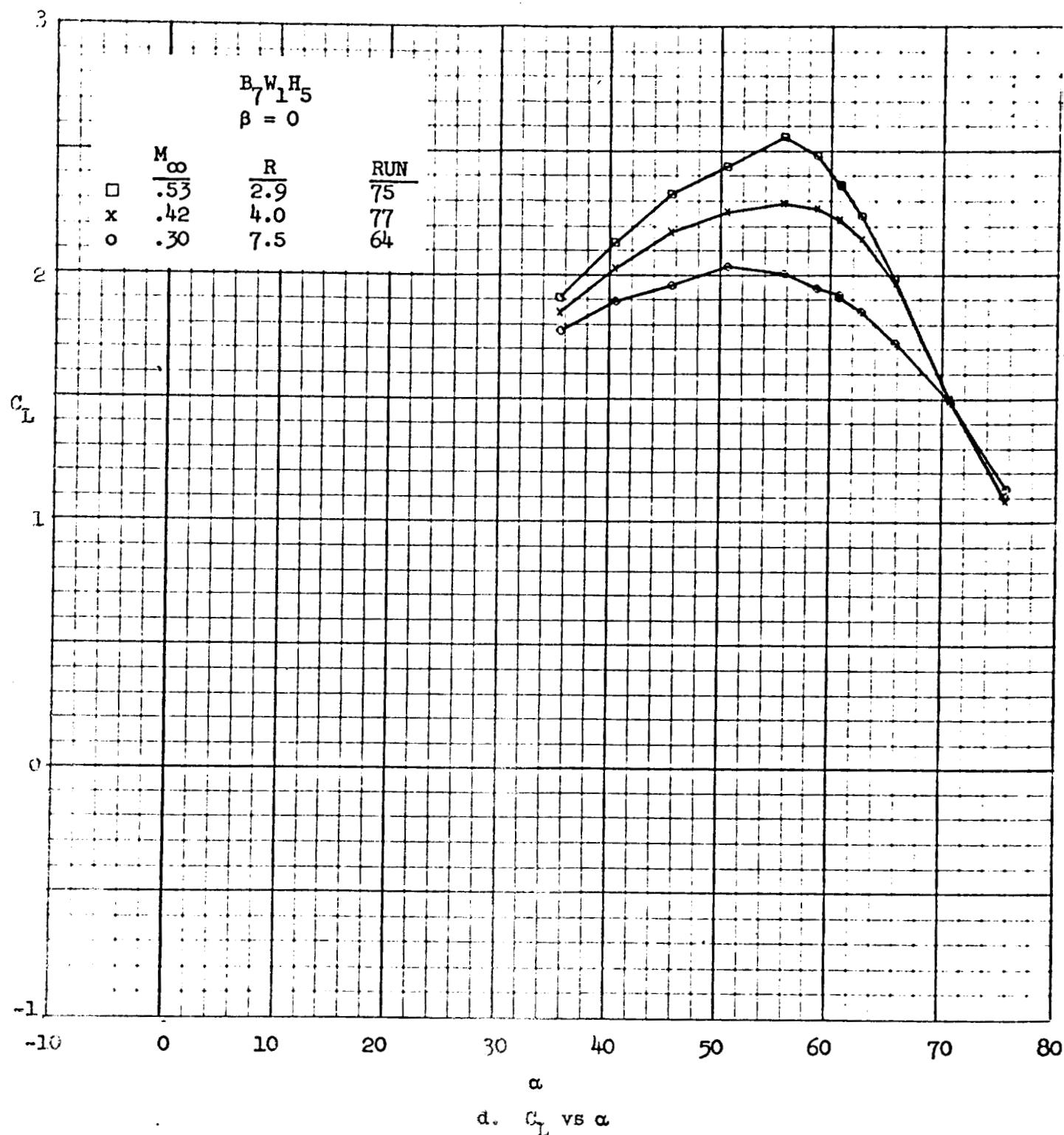
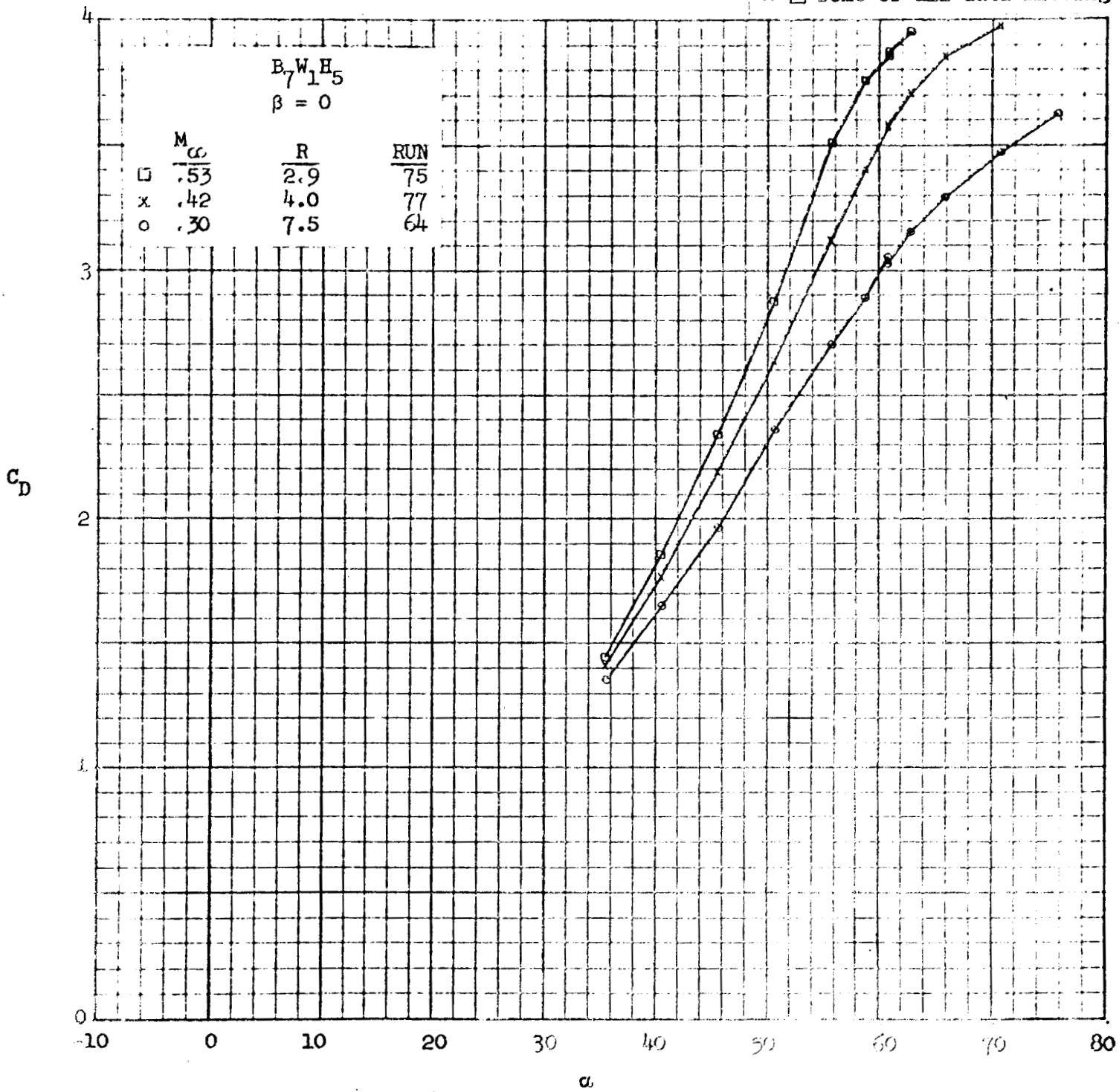


Figure 32. - Continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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$$e. \quad C_D \text{ vs } \alpha$$

Figure 32. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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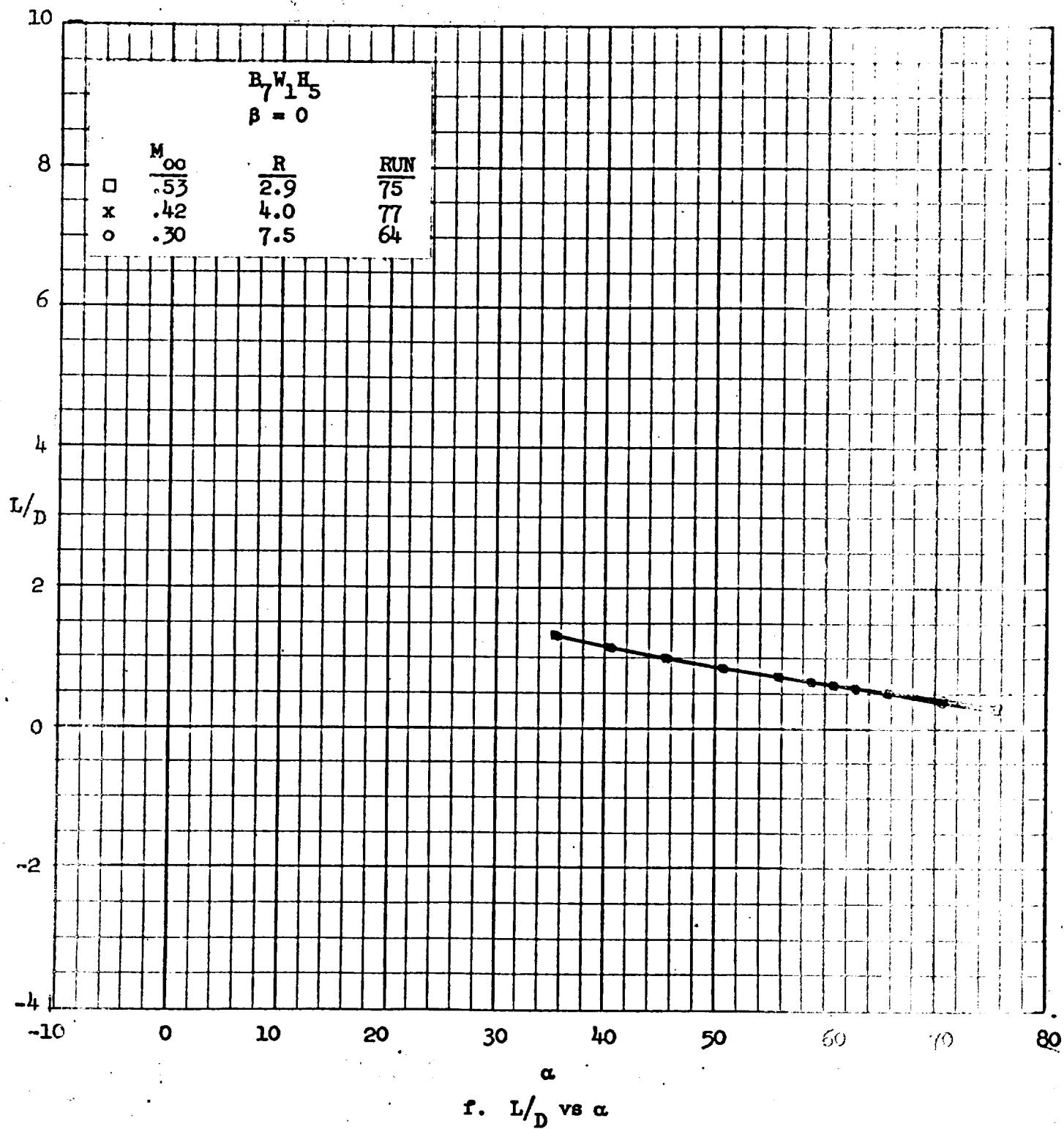


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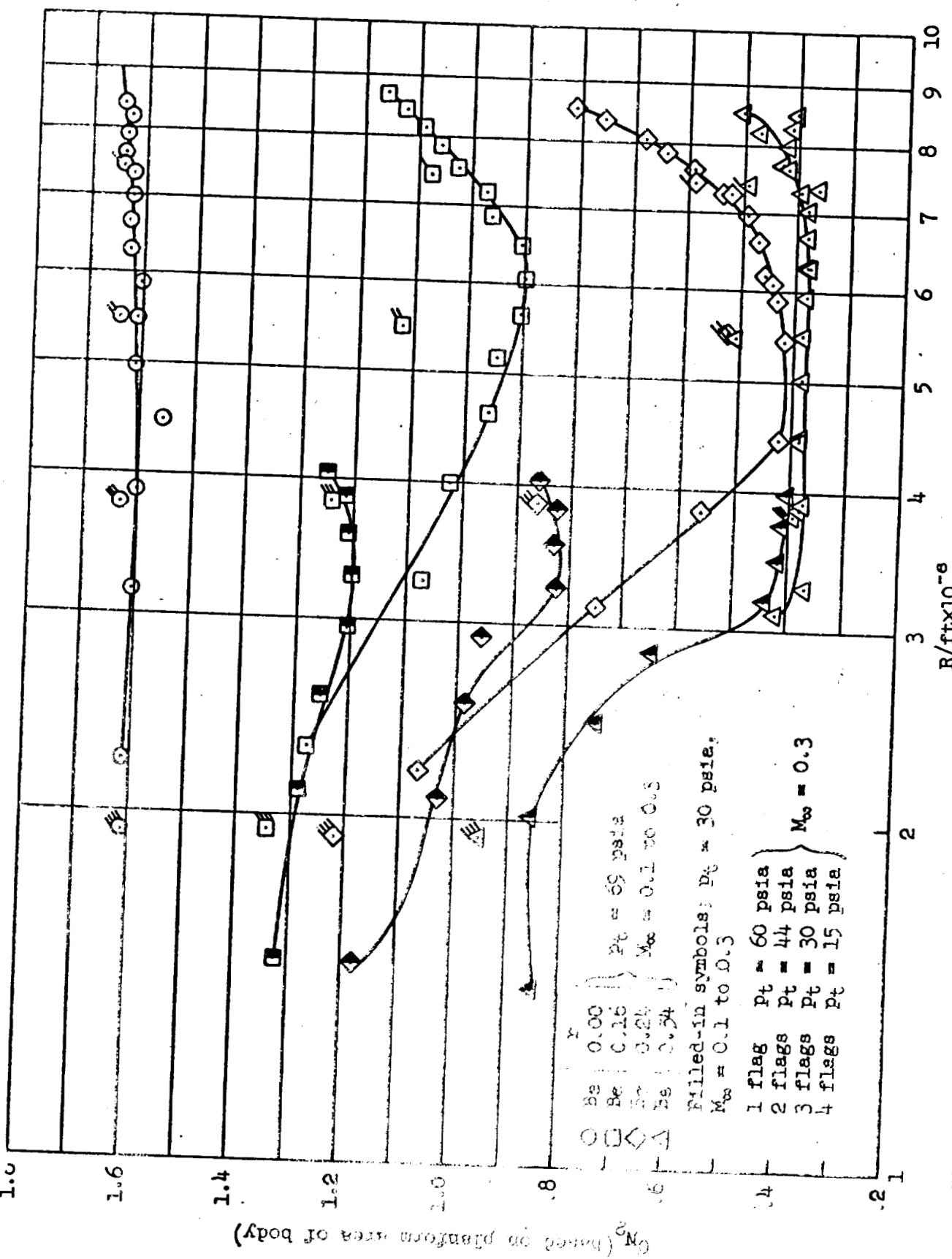
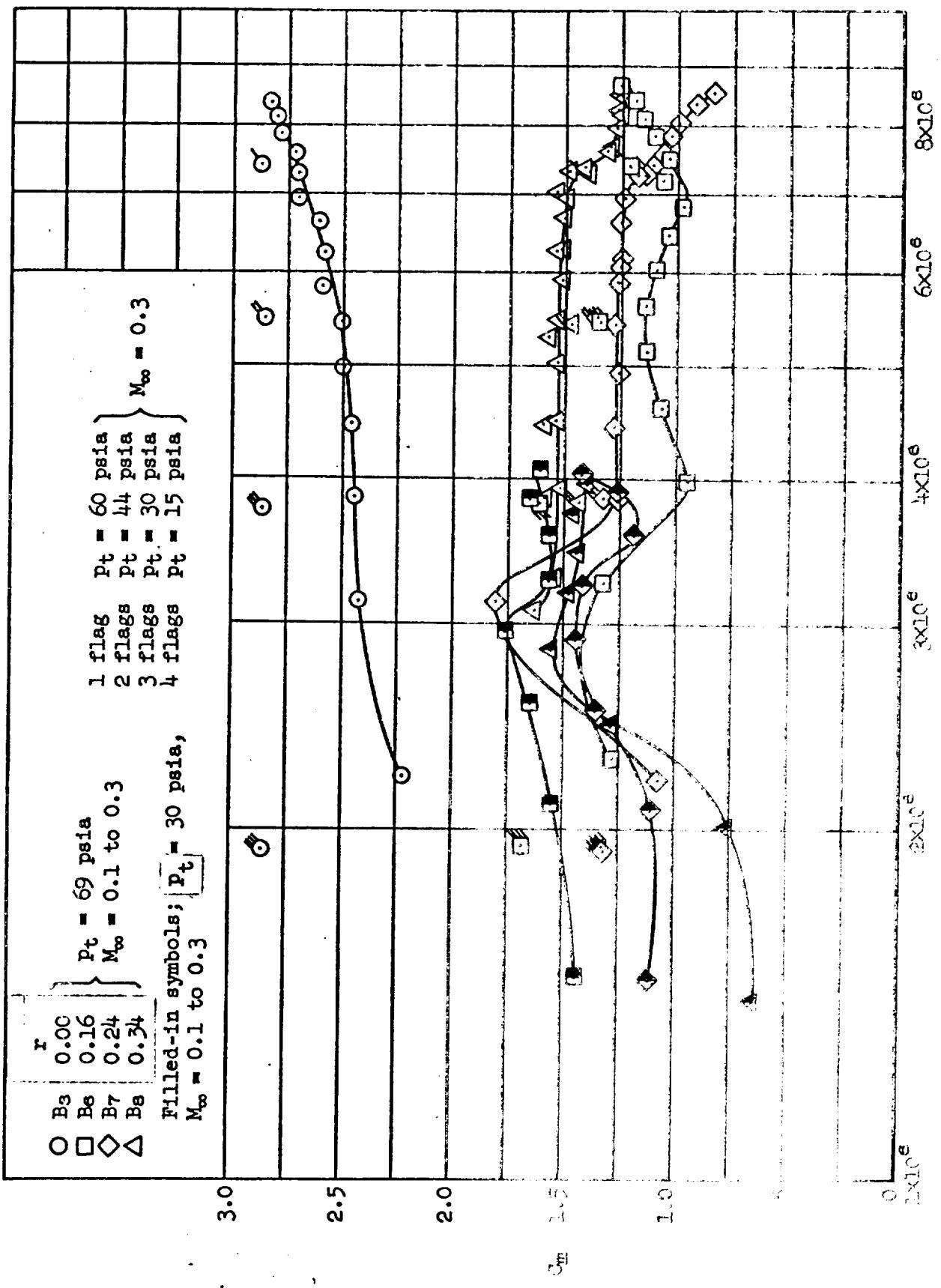


FIGURE 33. - Variation of normal force with Reynolds number for body only configuration, $\alpha = 60$ degrees.



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Figure 34. - Variation of pitching moment with Reynolds number for body only configuration, $\alpha = 60$ degrees.

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Ames Research Center: MOFFETT FIELD, CALIF.

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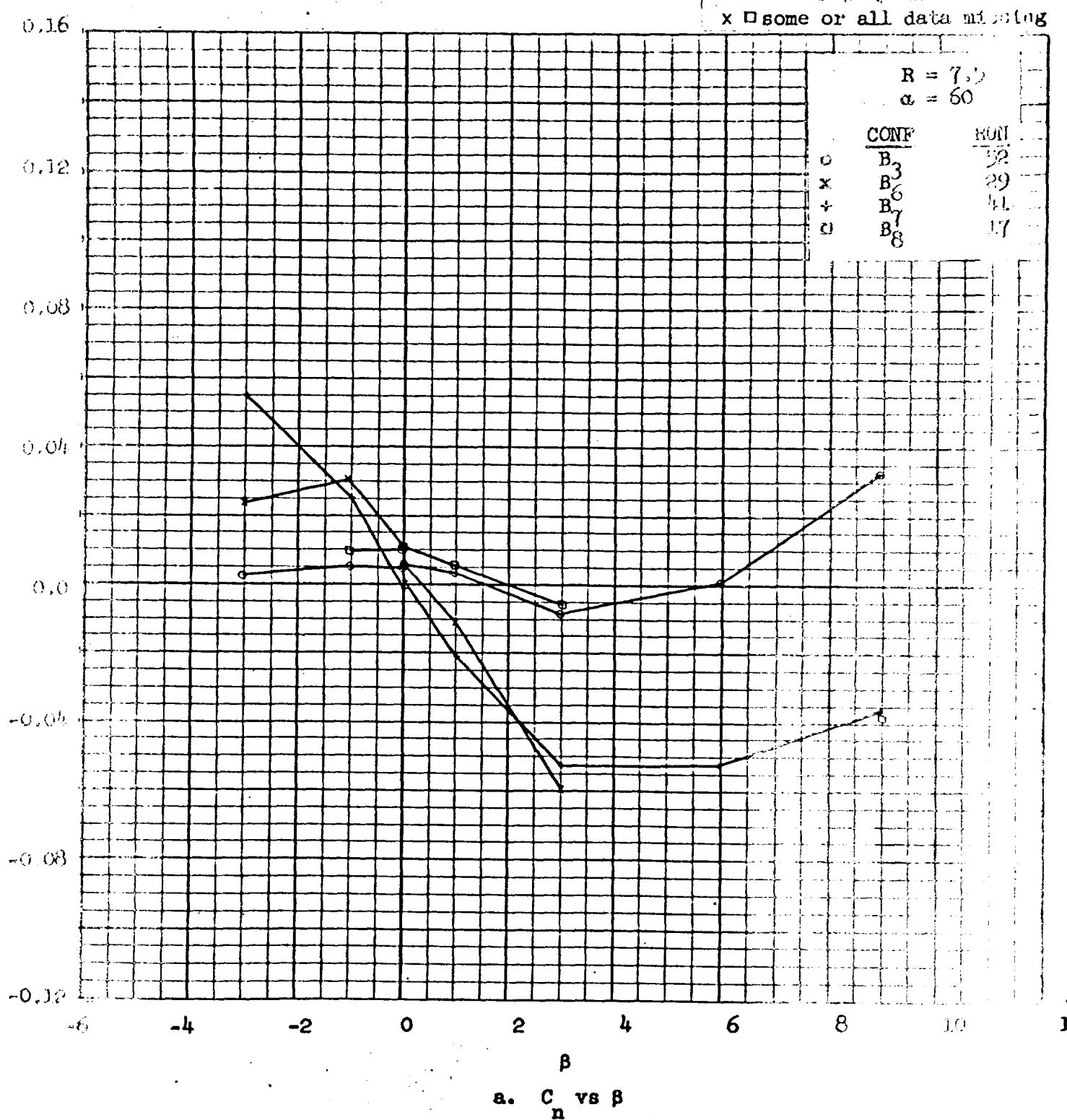


Figure 35. - Effect of sideslip angle on lateral characteristics with various corner radii for body only configuration, $\alpha = 60^\circ$ degrees, $R = 7.5$.

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA

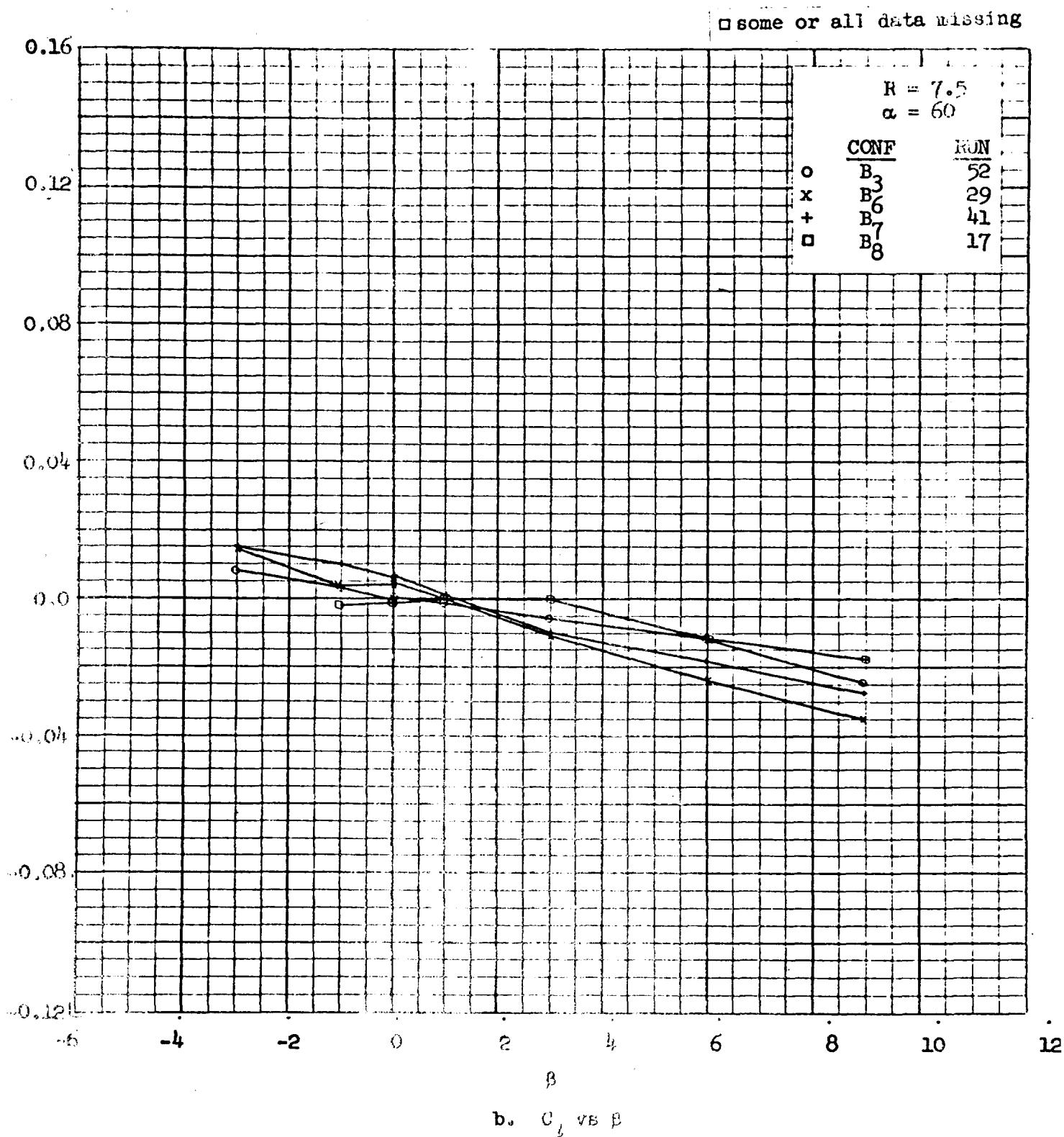


Figure 35. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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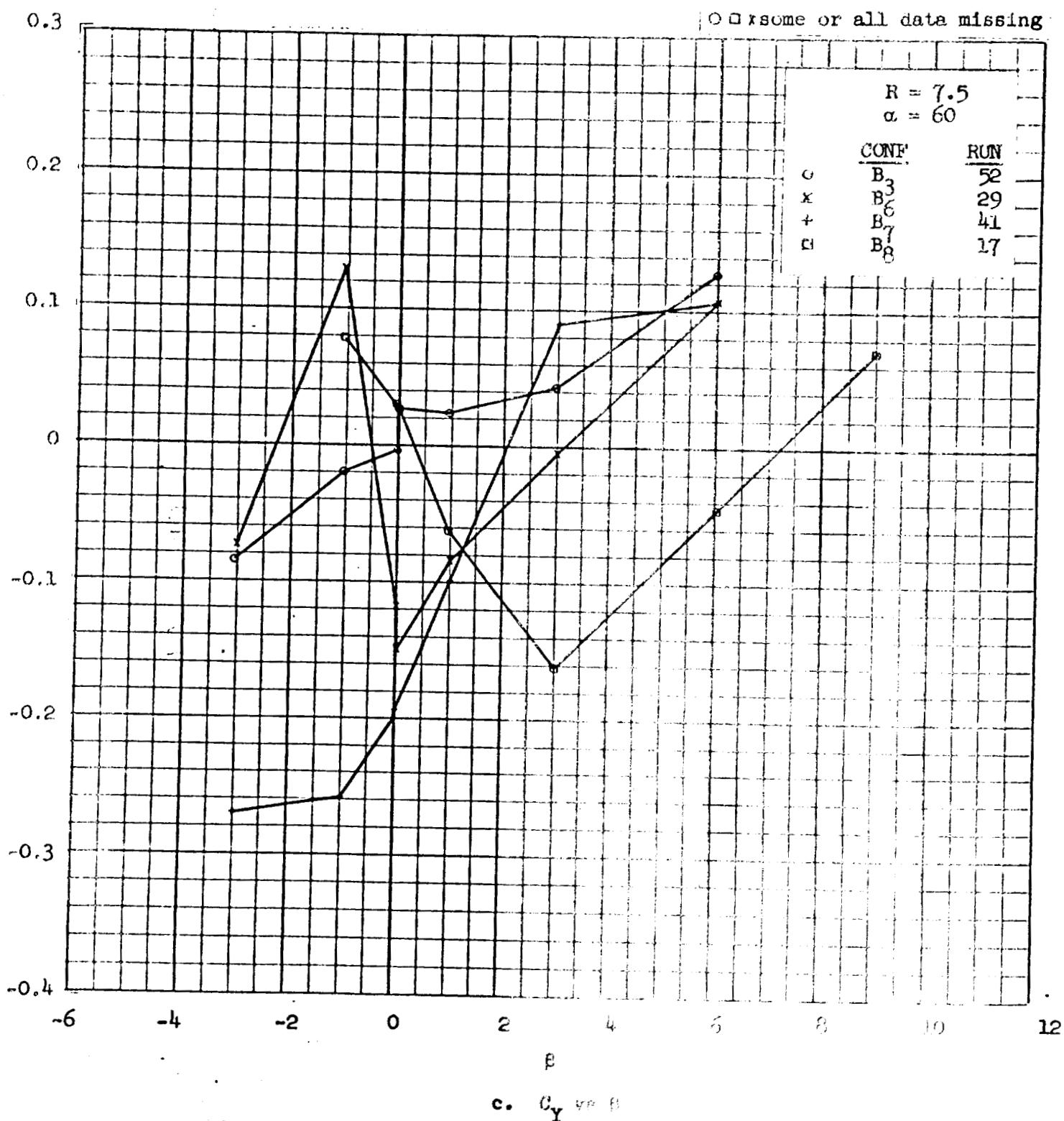


Figure 35. - concluded

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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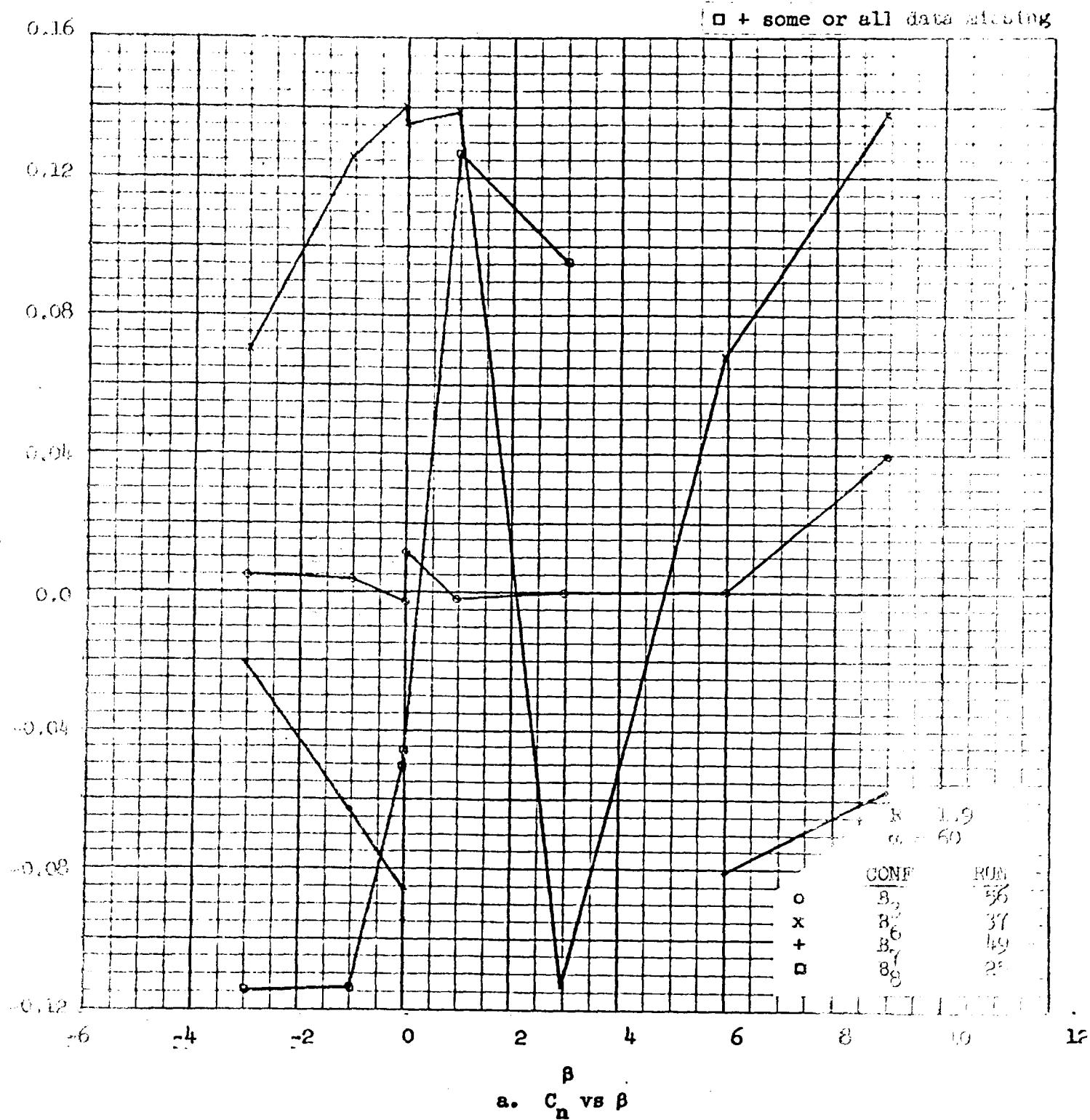


Figure 36. - Effect of sideslip angle on lateral characteristics with various body corner radii for body only configuration, $\alpha = 60$ degrees, $M = 1.9$.

National Aeronautics and Space Administration
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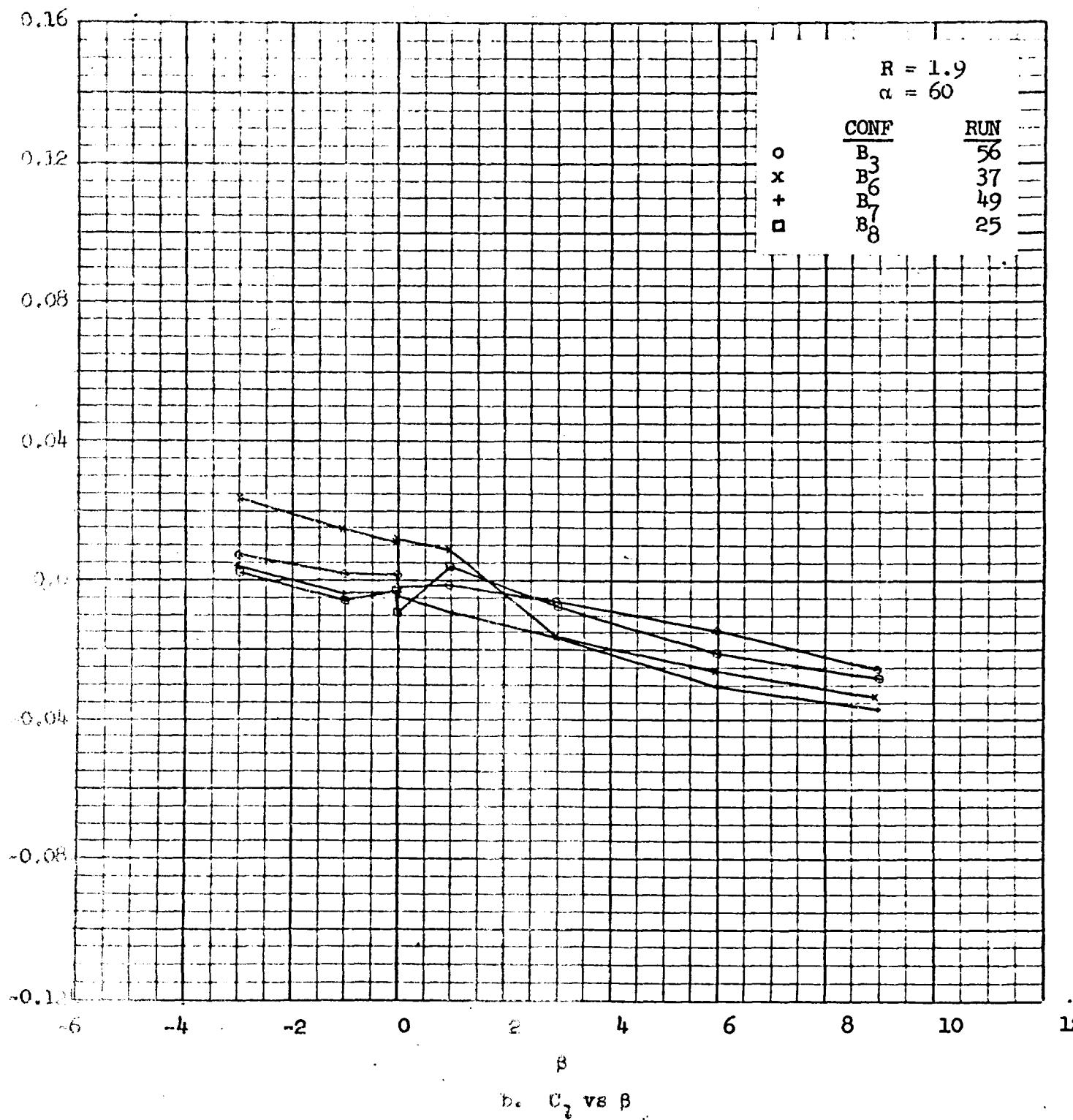


Figure 36. ~ continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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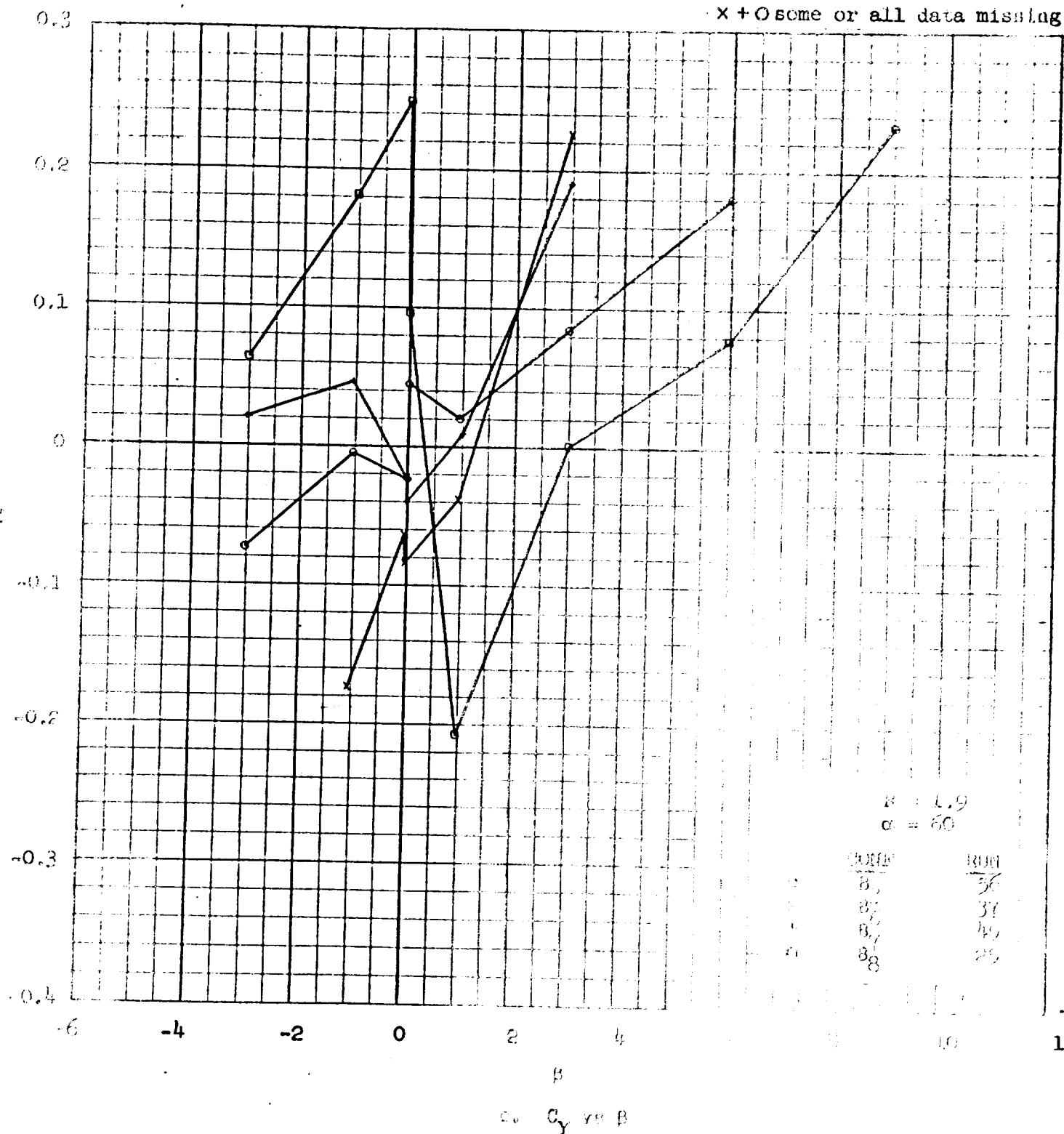


Figure 36. - concluded

National Aeronautics and Space Administration
 Ames Research Center: MOFFETT FIELD, CALIF.

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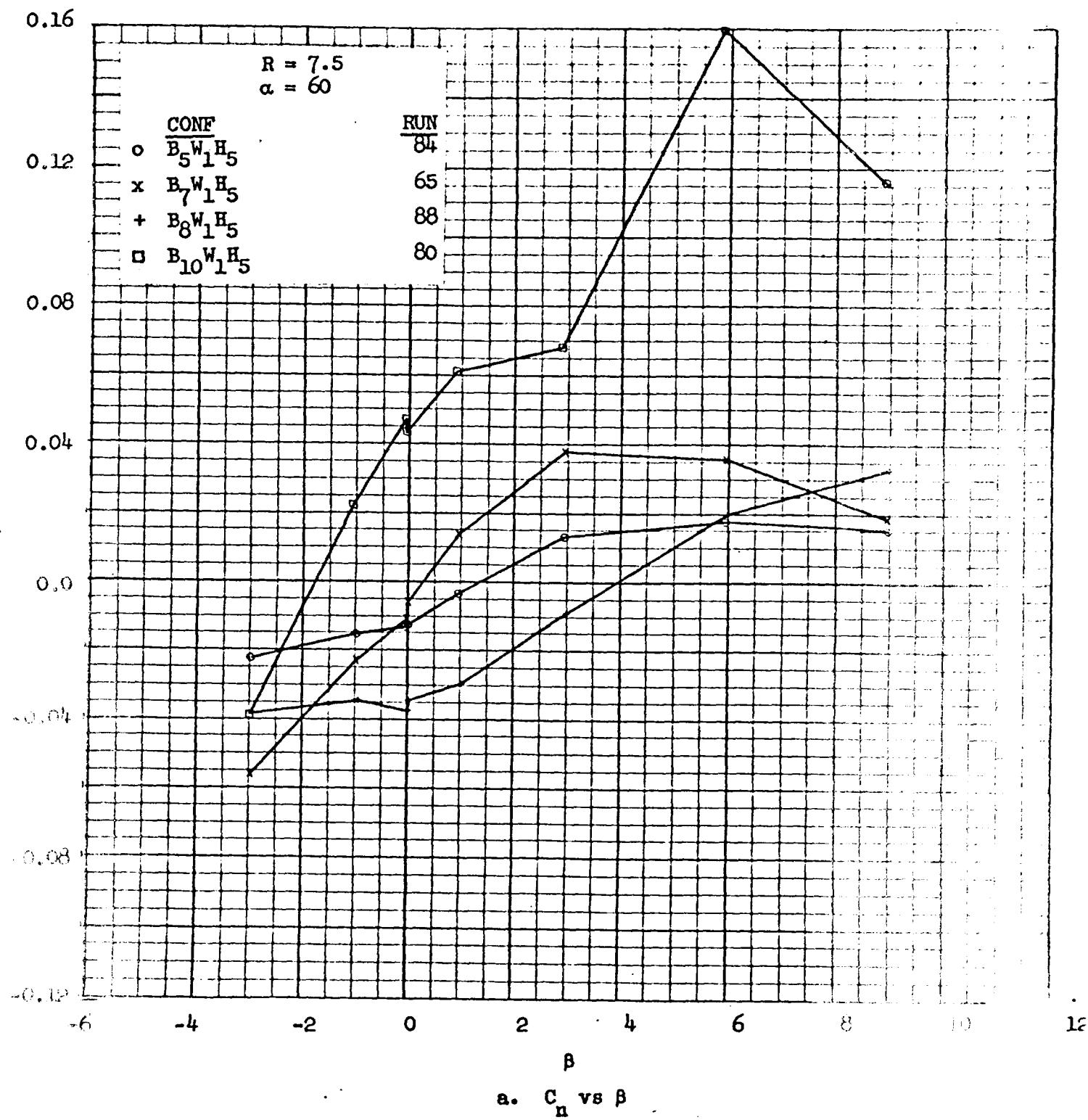


Figure 37. - Effect of sideslip angle on lateral characteristics with various body corner radii for complete model configuration, $\alpha = 60$ degrees, $R = 7.5$.

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA

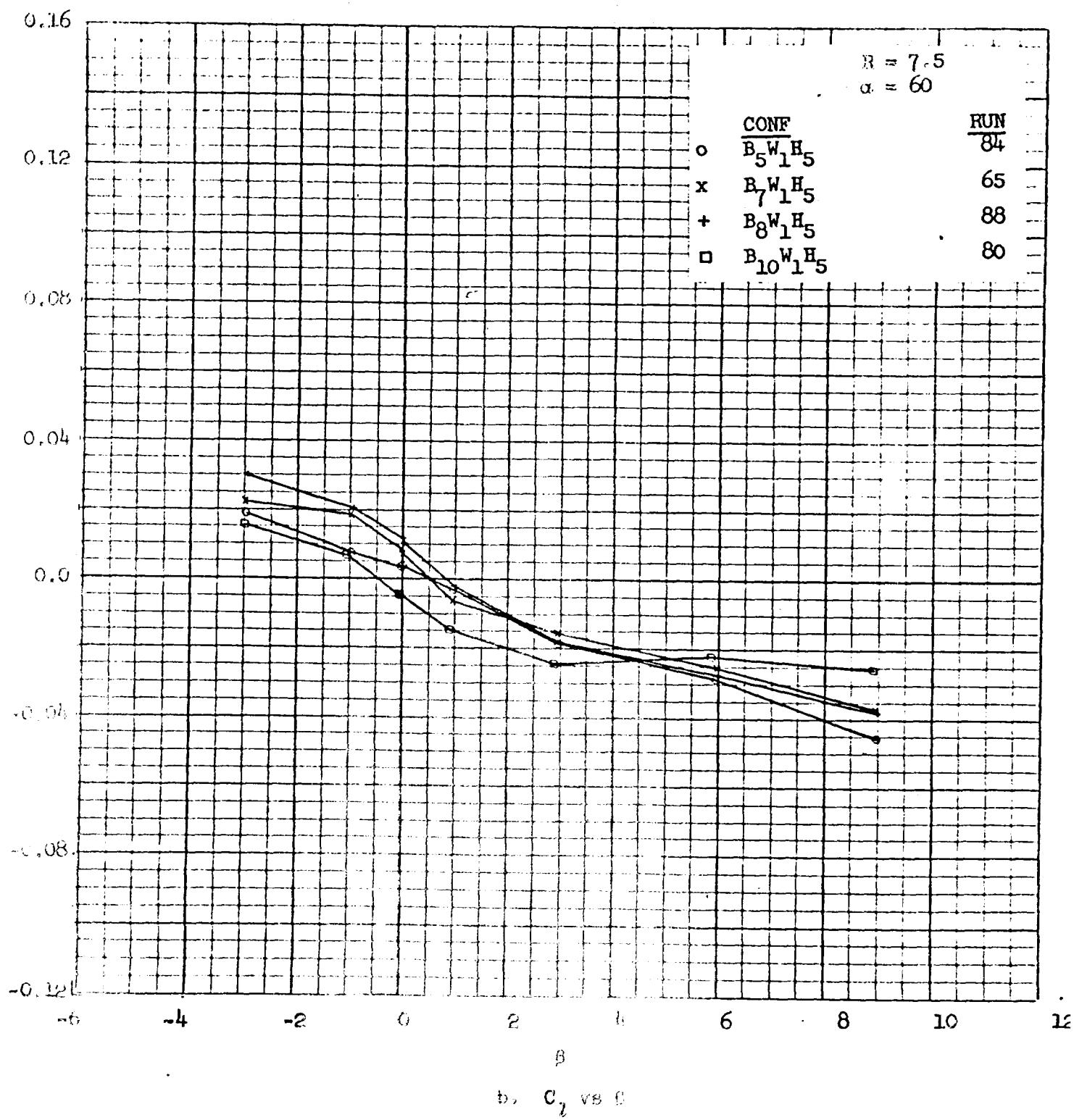


Figure 37. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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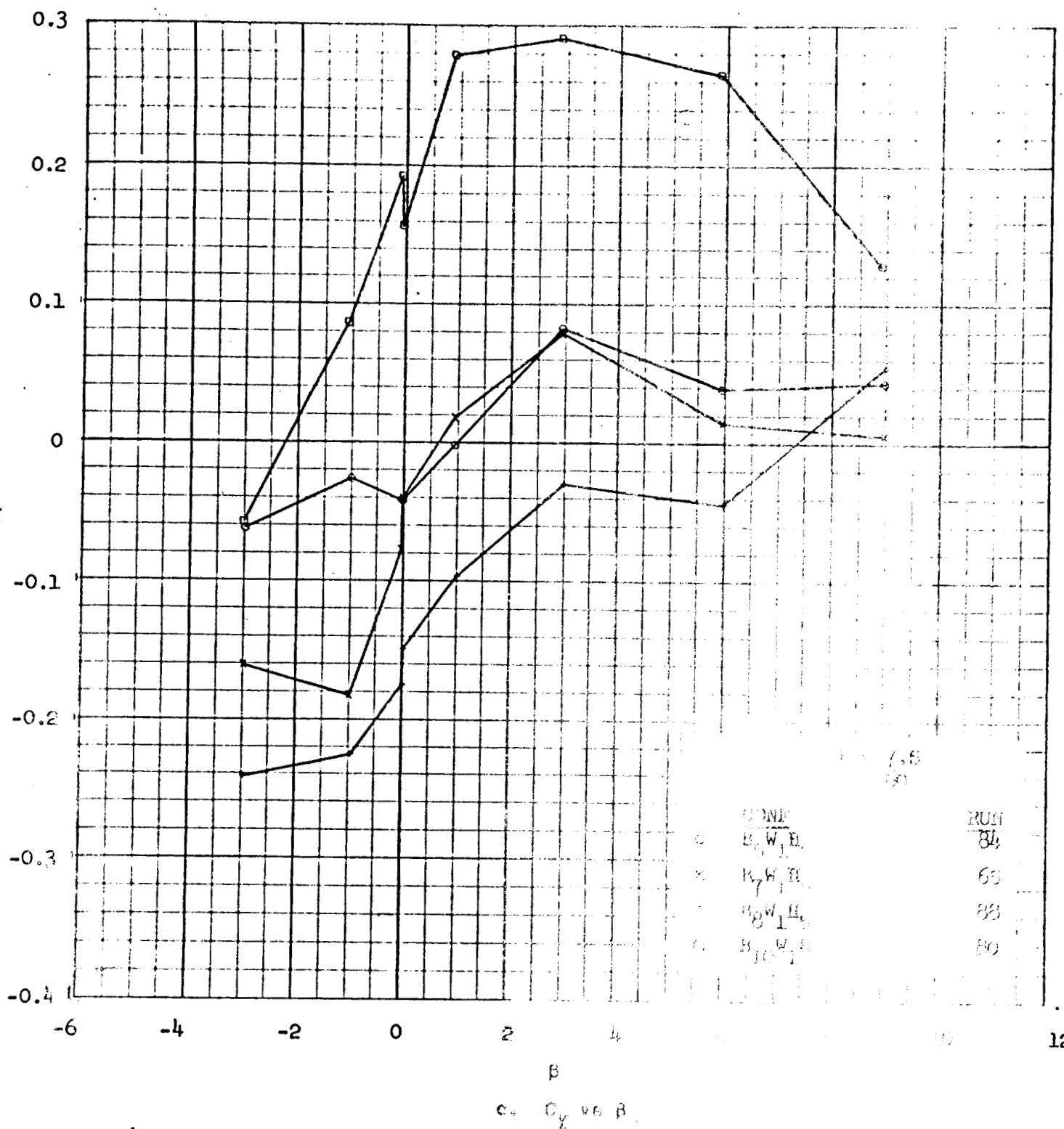


Figure 37. - concluded

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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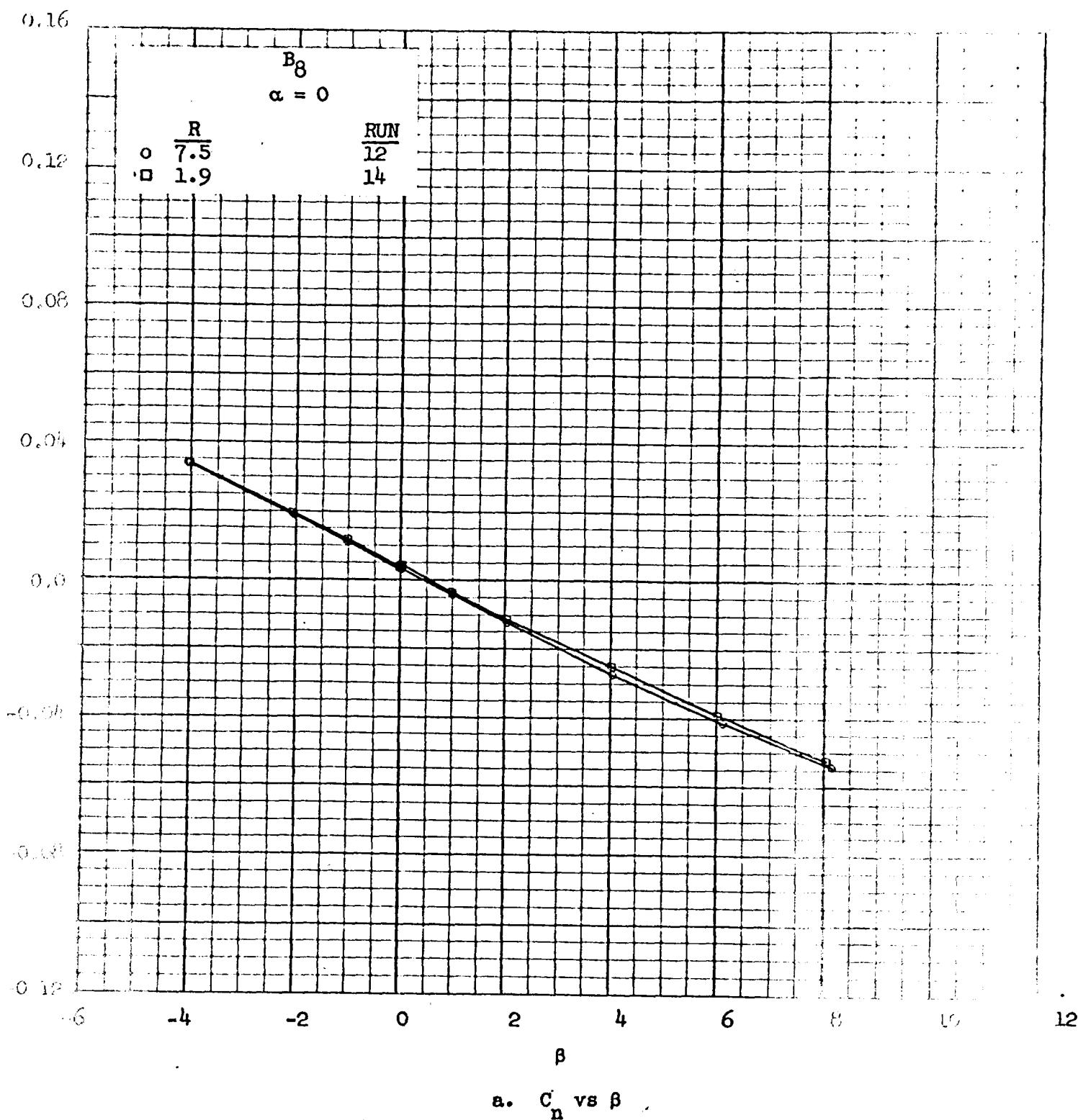


Figure 38. - Effect of sideslip angle on lateral characteristics at various Reynolds numbers, $\alpha = 0$ degrees, B_8 .

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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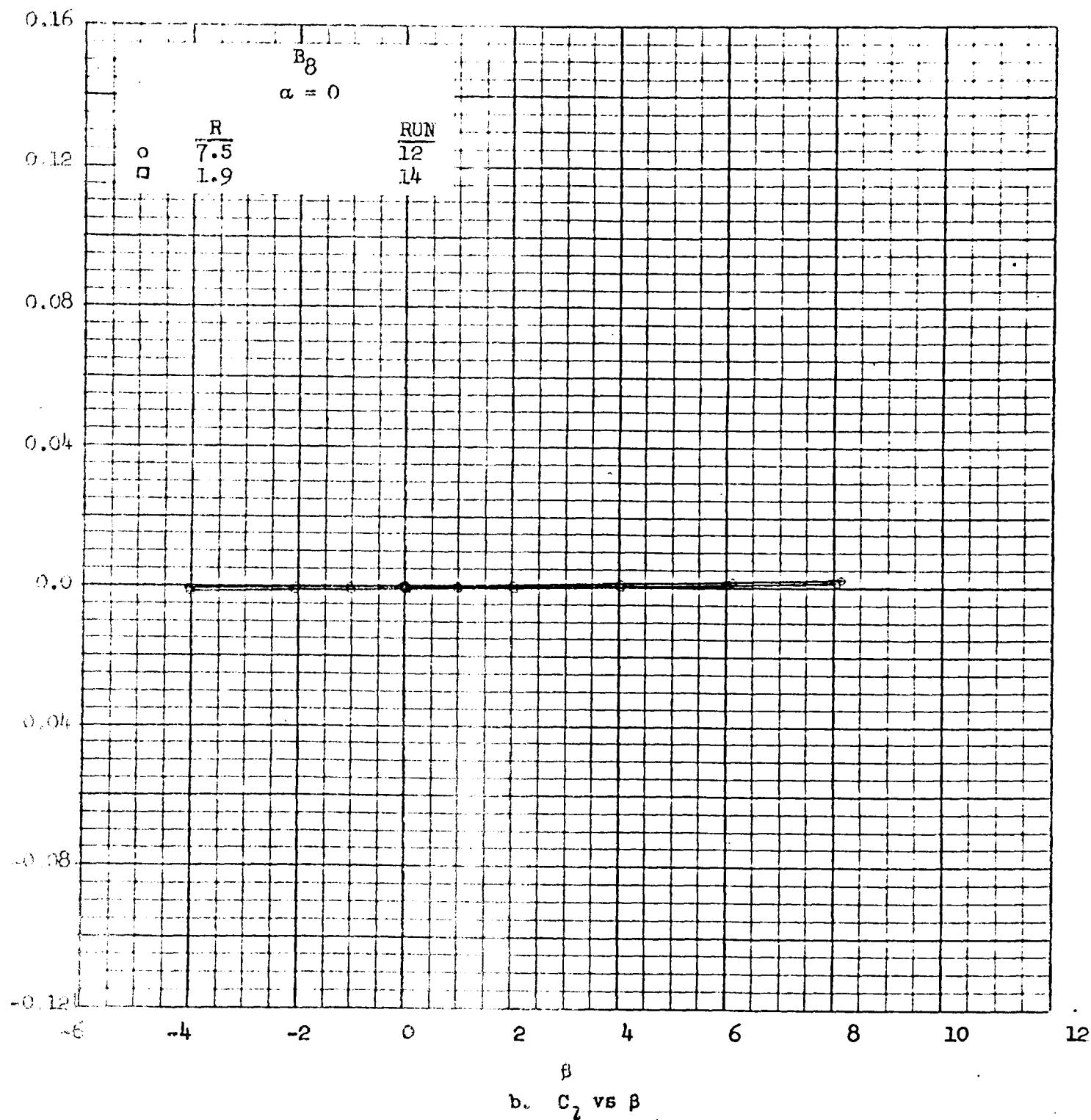


Figure 38. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA

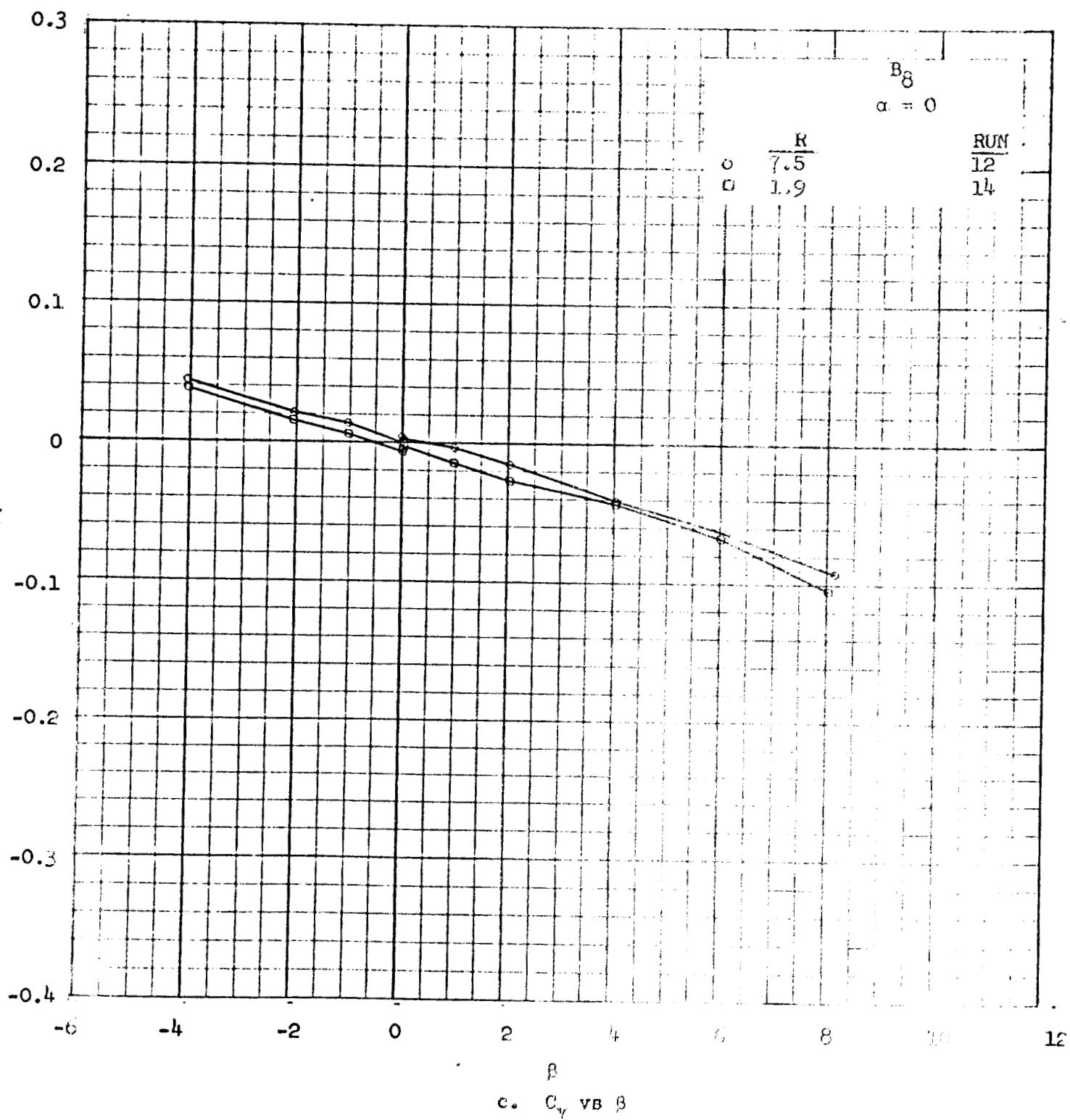


Figure 38. - concluded

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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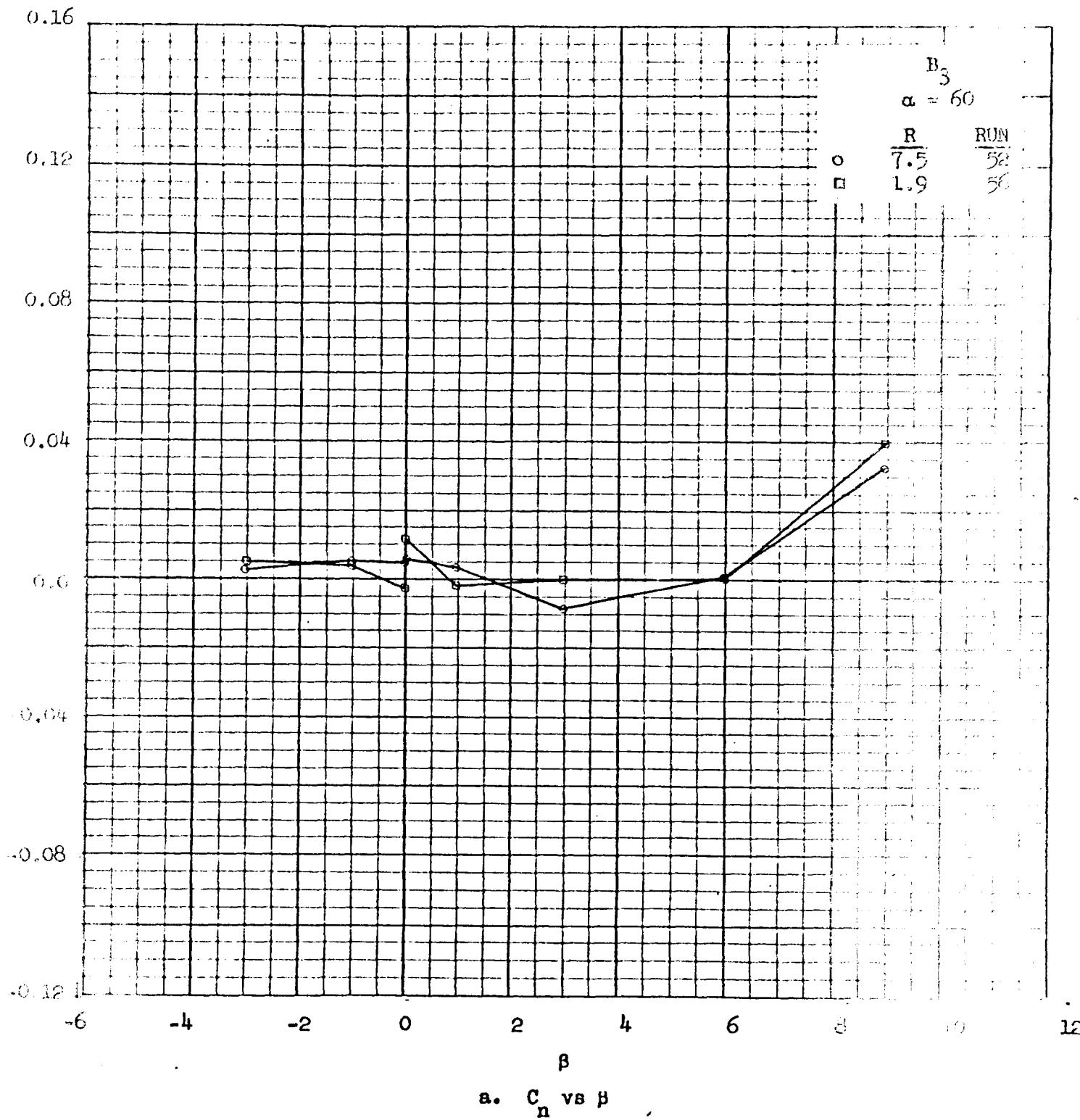


Figure 39. - Effect of sideslip angle on lateral characteristics at various Reynolds numbers for body only configuration, $\alpha = 60^\circ$.

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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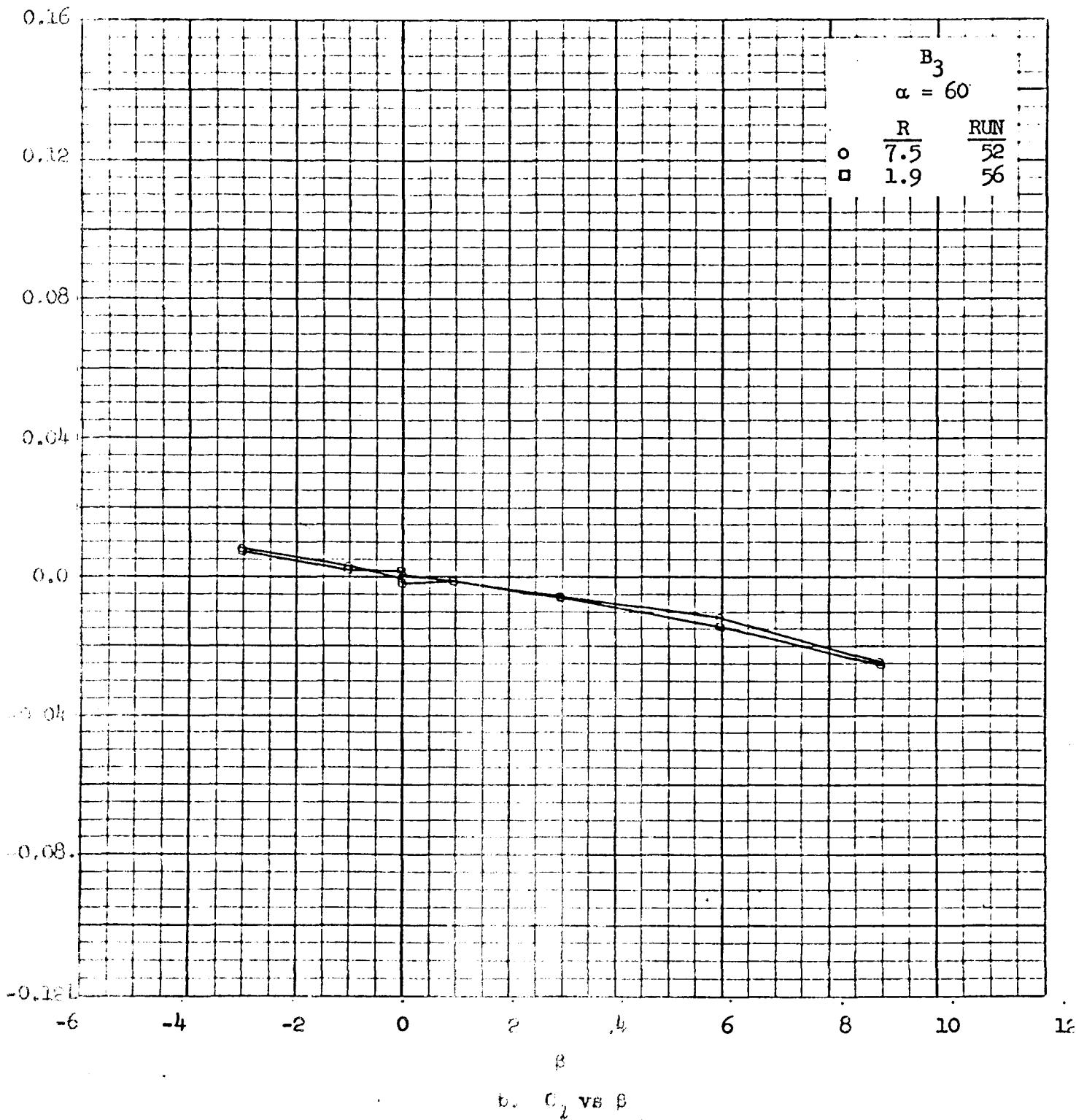


Figure 39. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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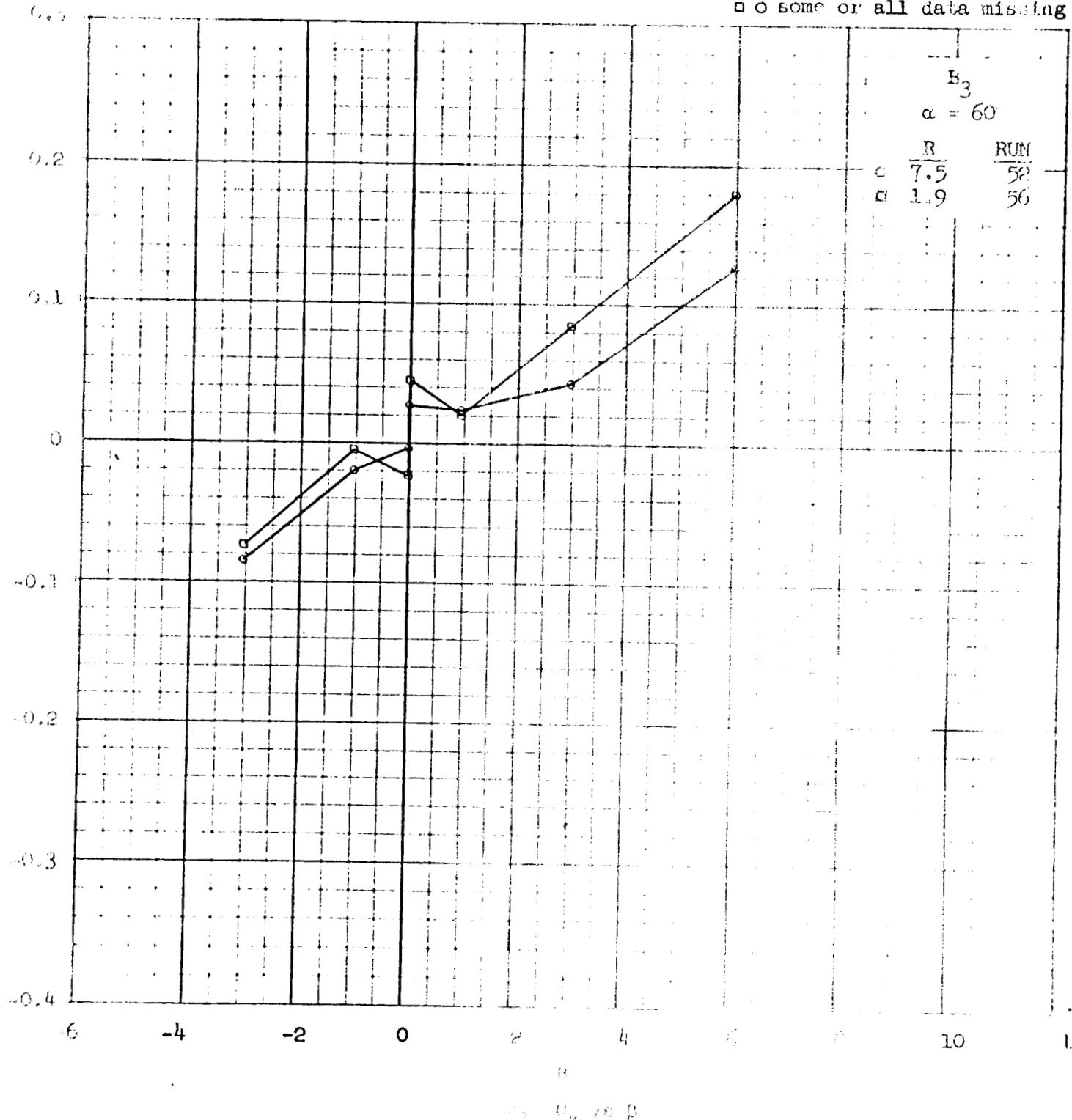


Figure 39. - concluded

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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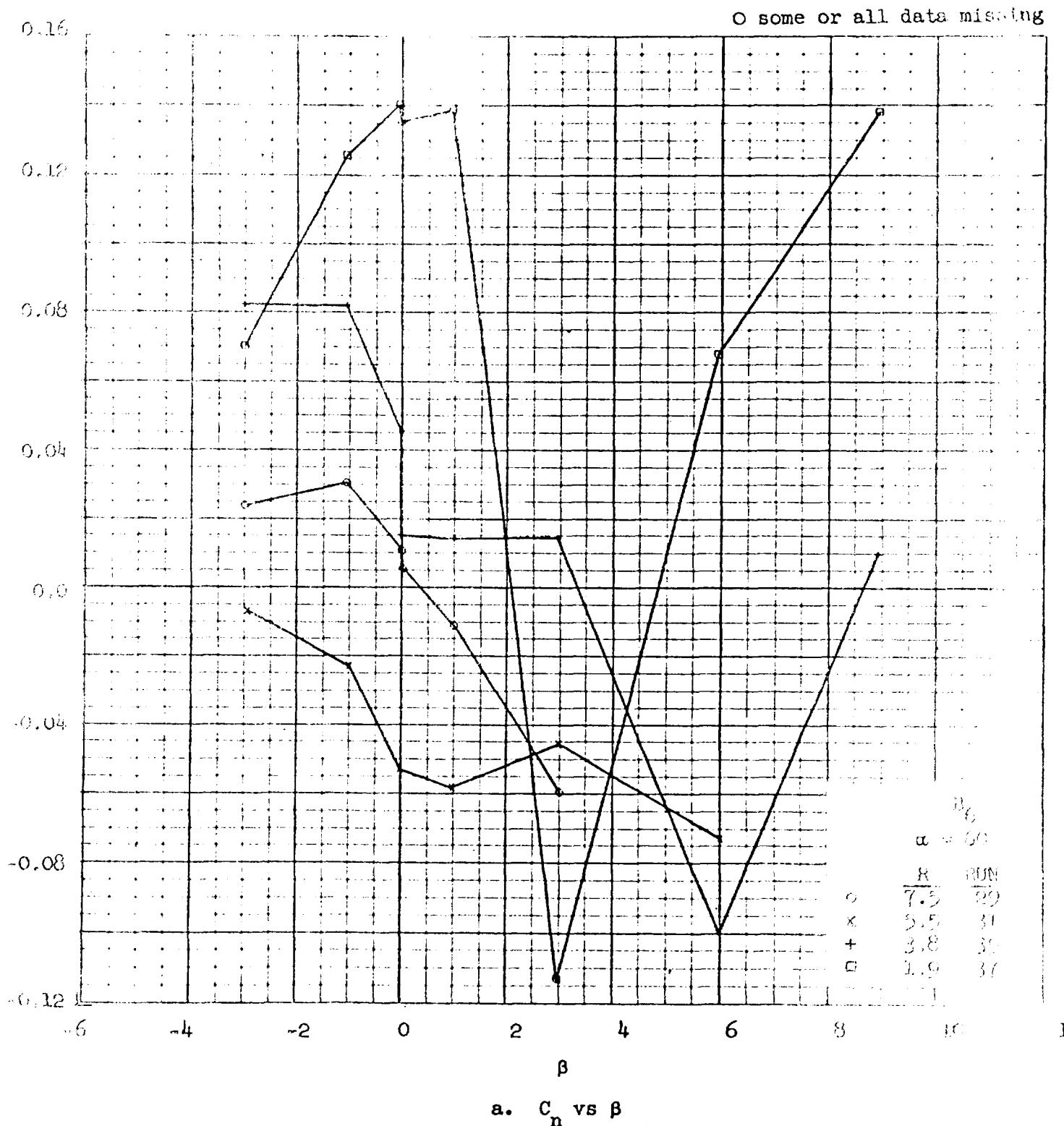


Figure 40. - Effect of sideslip angle on lateral characteristics at various Reynolds numbers for body only configuration, $\alpha = 60$ degrees.

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA

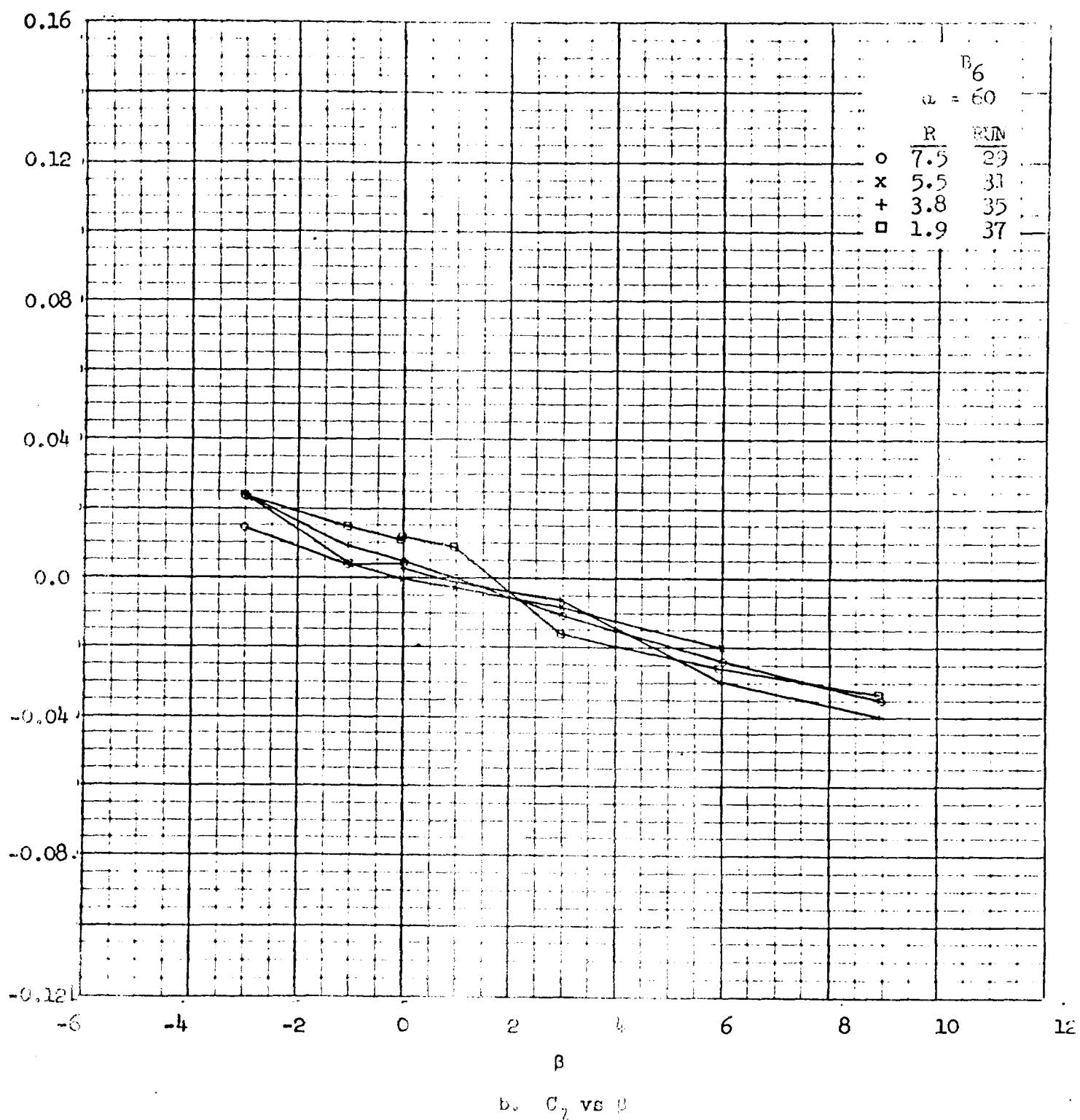


Figure 40. - continued.

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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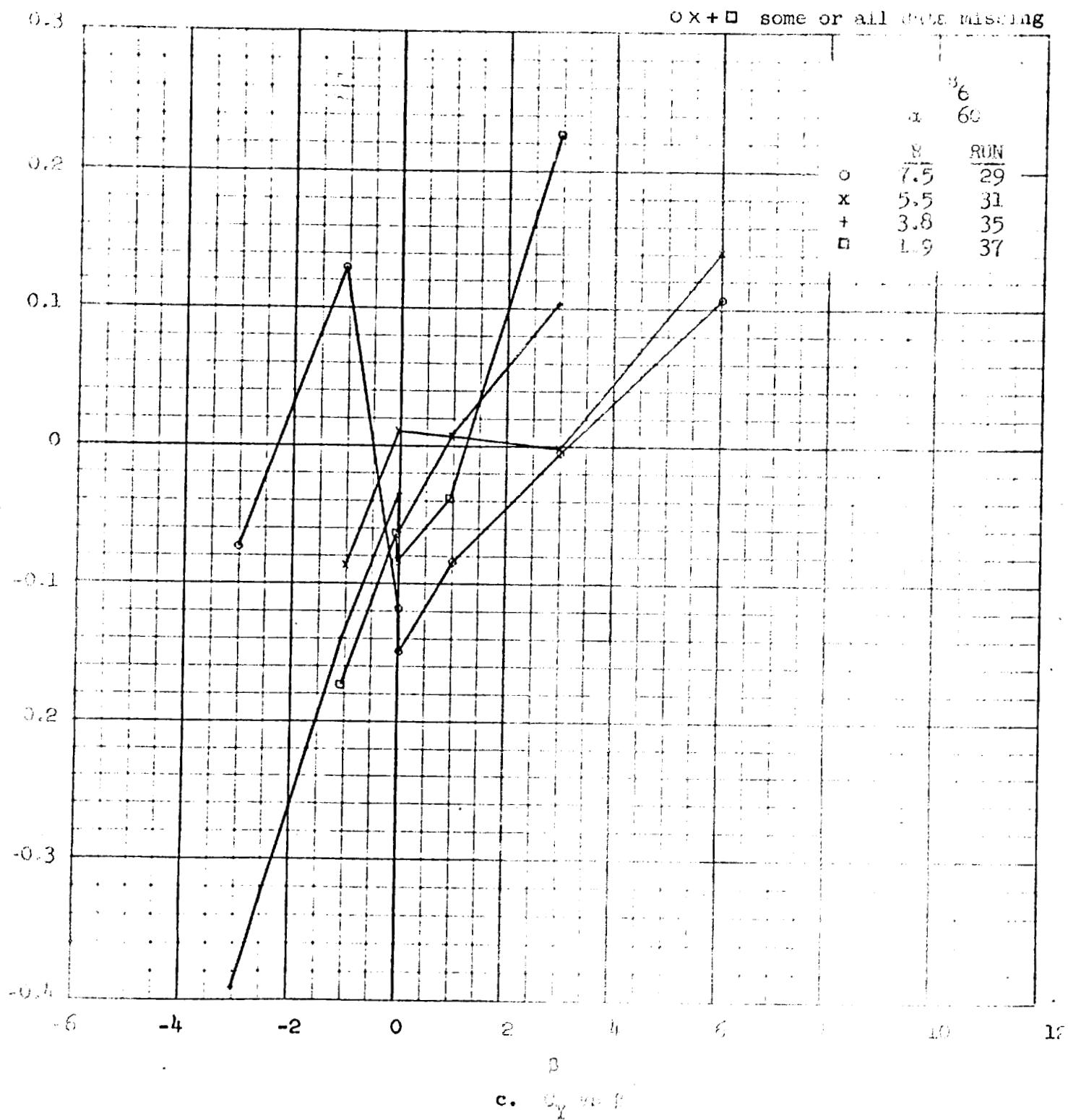


Figure 40. - concluded

National Aeronautics and Space Administration
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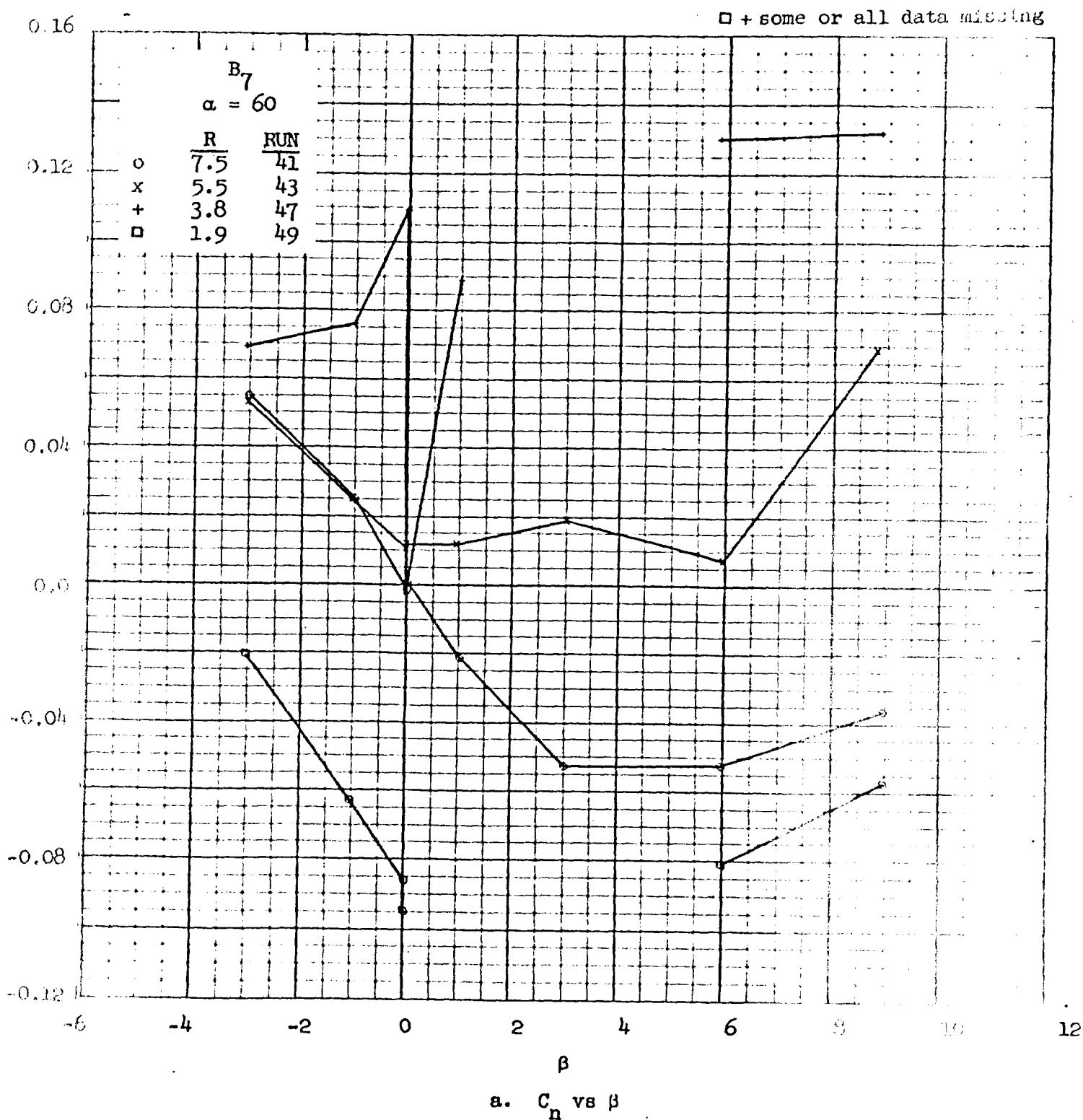


Figure 41. - Effect of sideslip angle on lateral characteristics at various Reynolds numbers for body only configuration, $\alpha = 60^\circ$. (continued)

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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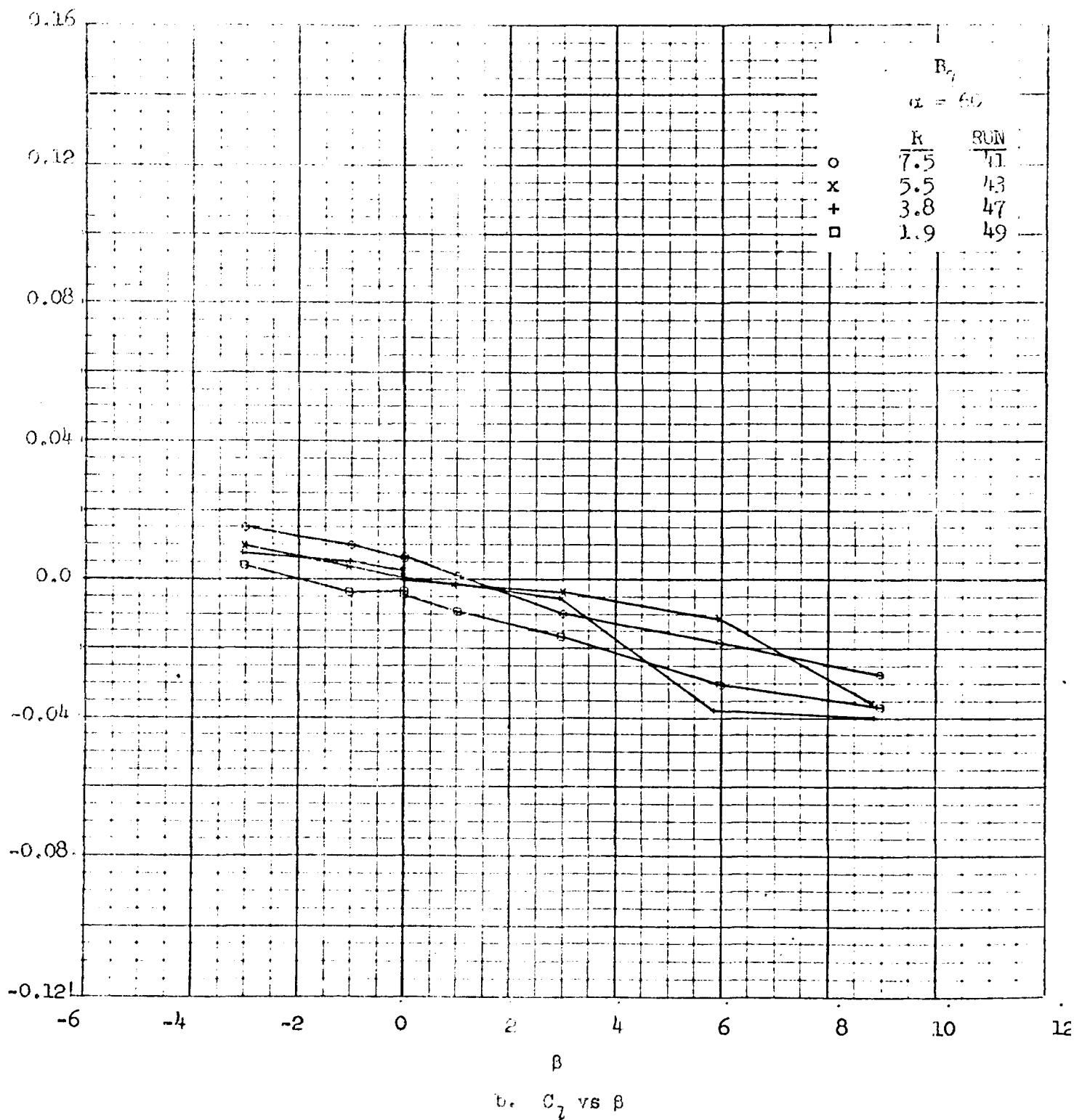


Figure 41. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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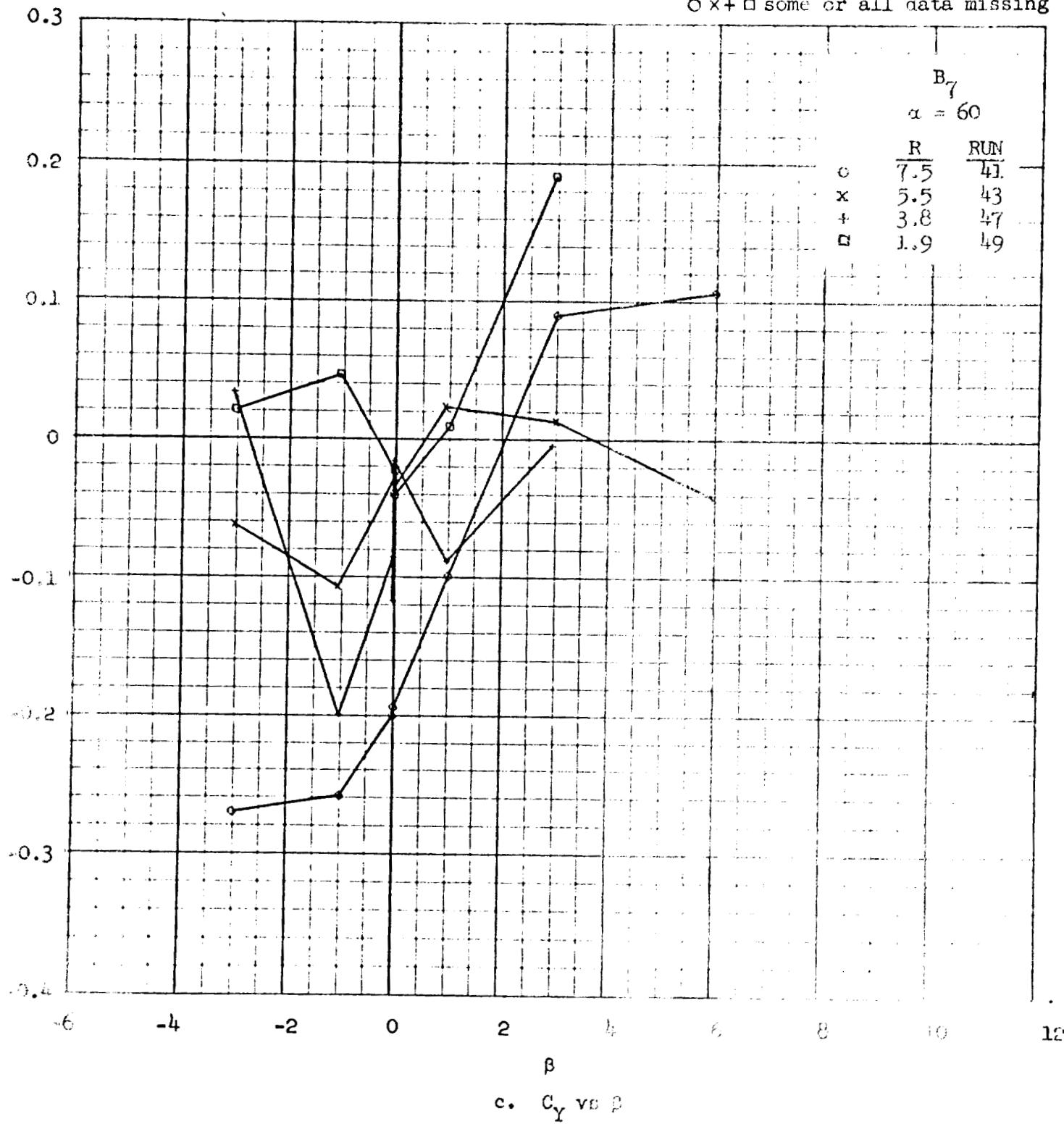


Figure 41. - concluded

National Aeronautics and Space Administration
Ames Research Center, MOFFETT FIELD, CALIF.

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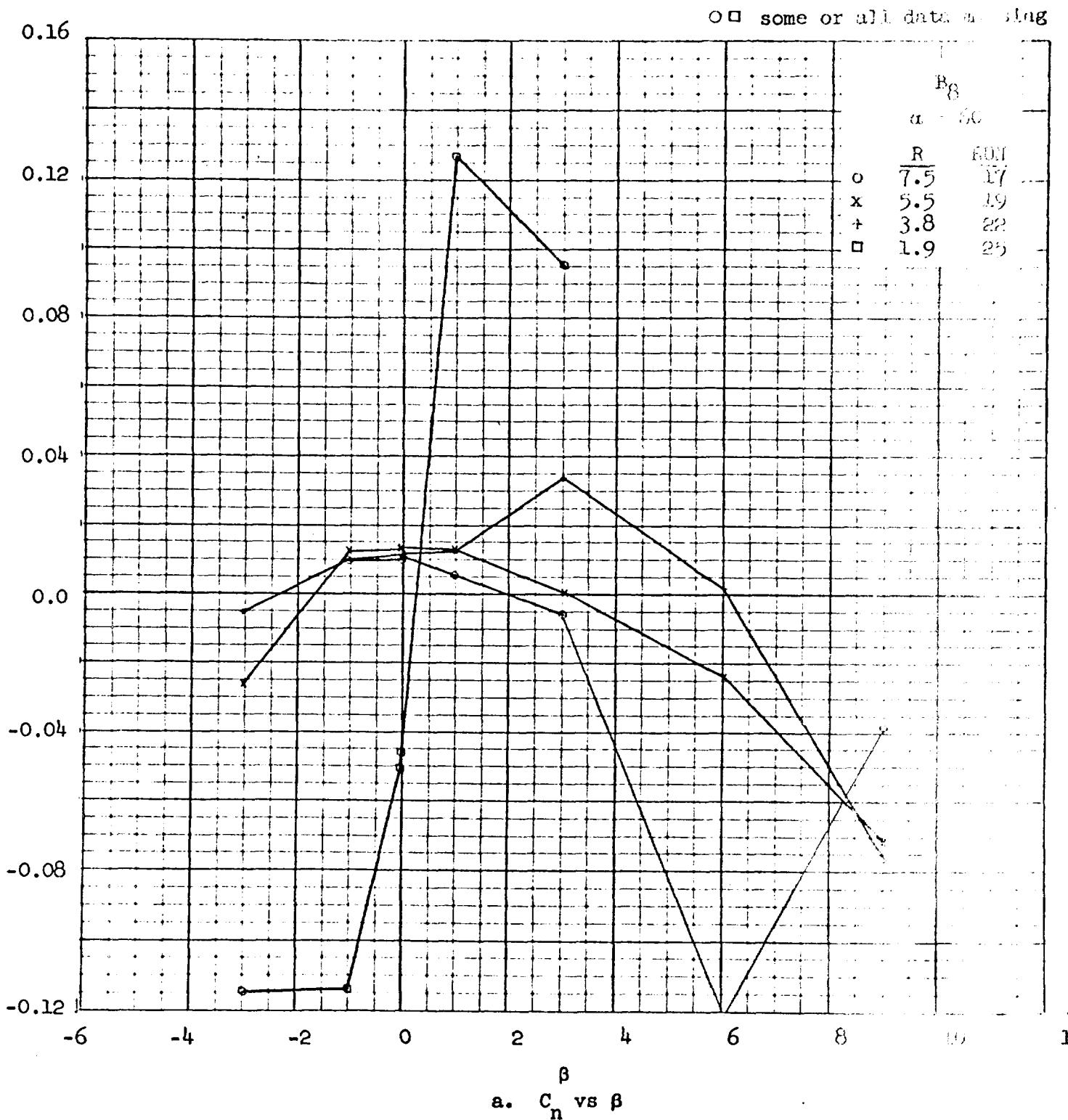
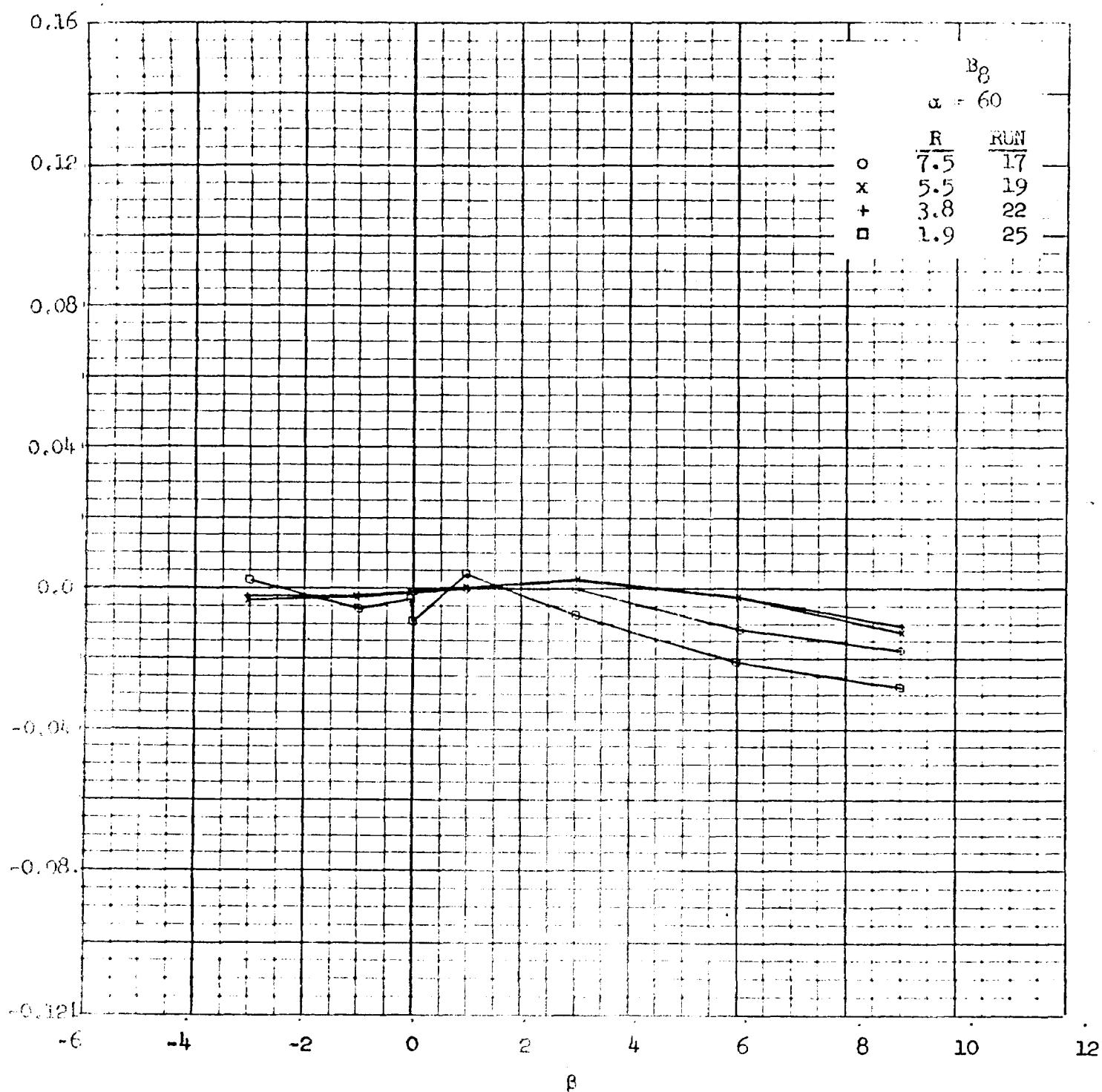


Figure 42. - Effect of sideslip angle on lateral characteristics at various Reynolds numbers for body only configuration, $\alpha = 60$ degrees.

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



$b. C_l \text{ vs } \beta$

Figure 42. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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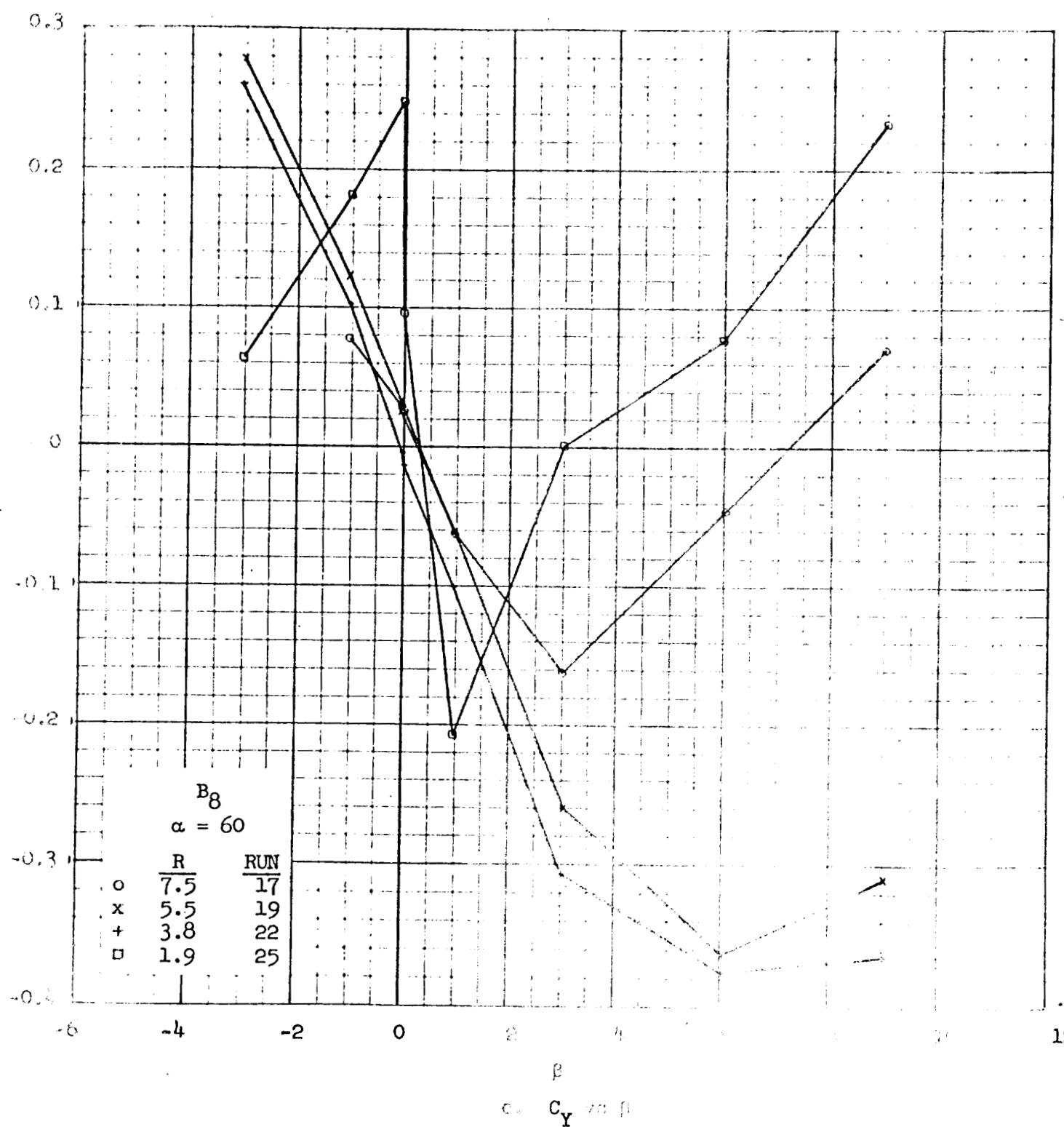


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National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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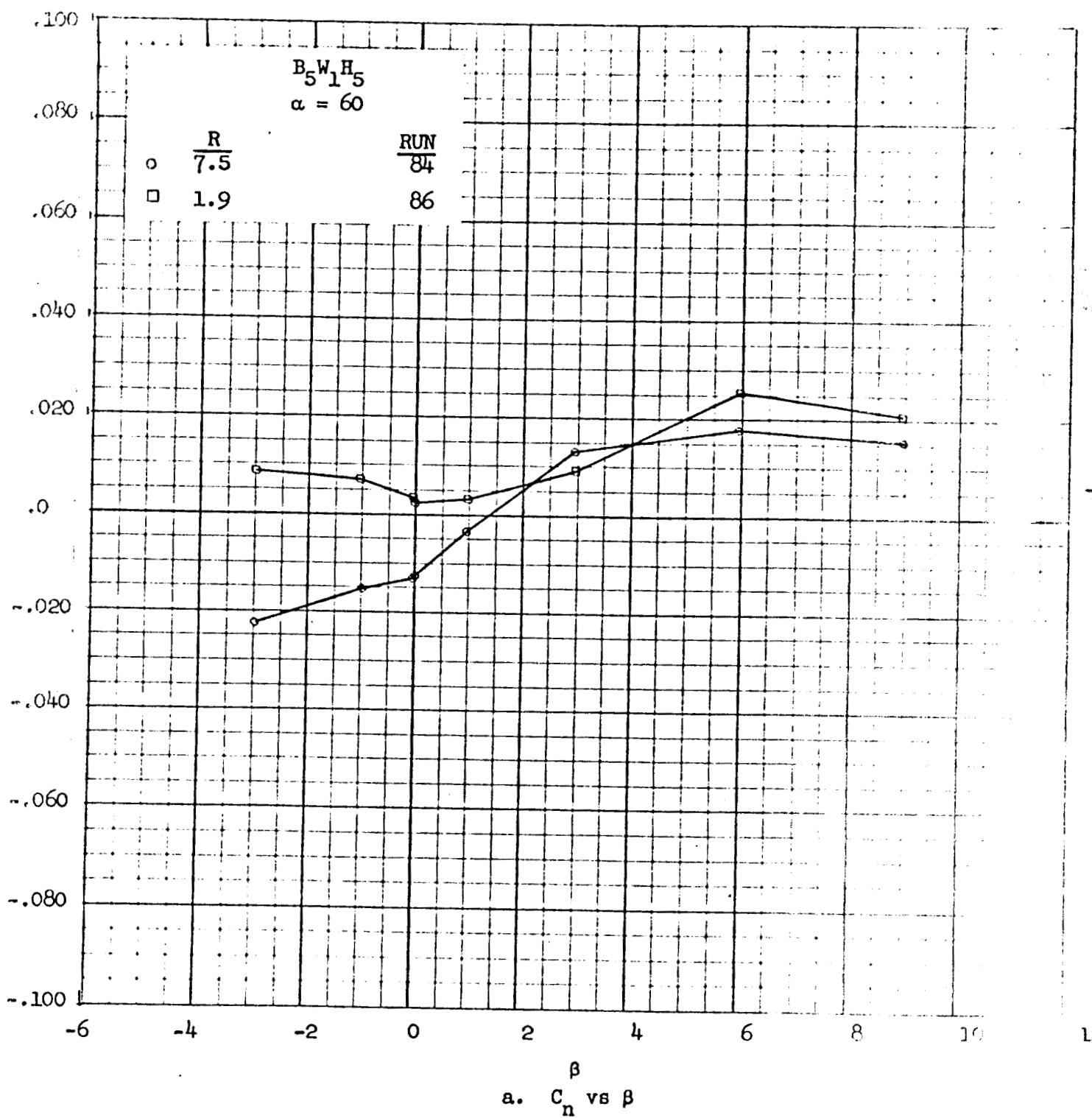


Figure 43. - Effect of sideslip angle on lateral characteristics at various Reynolds numbers for several model configurations, $\alpha = 60$ degrees.
 $B_5 W_1 H_5$

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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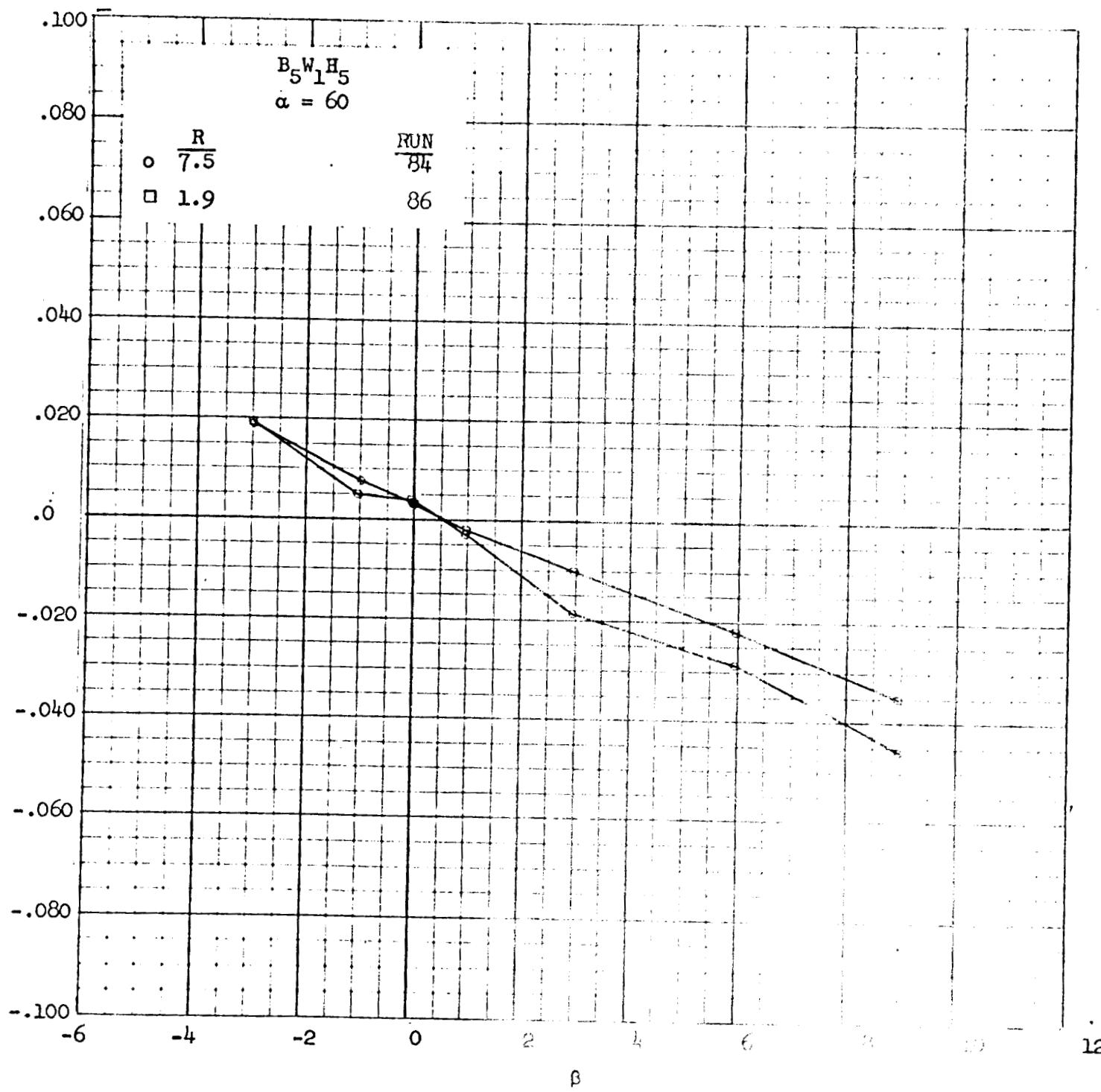


Figure 43. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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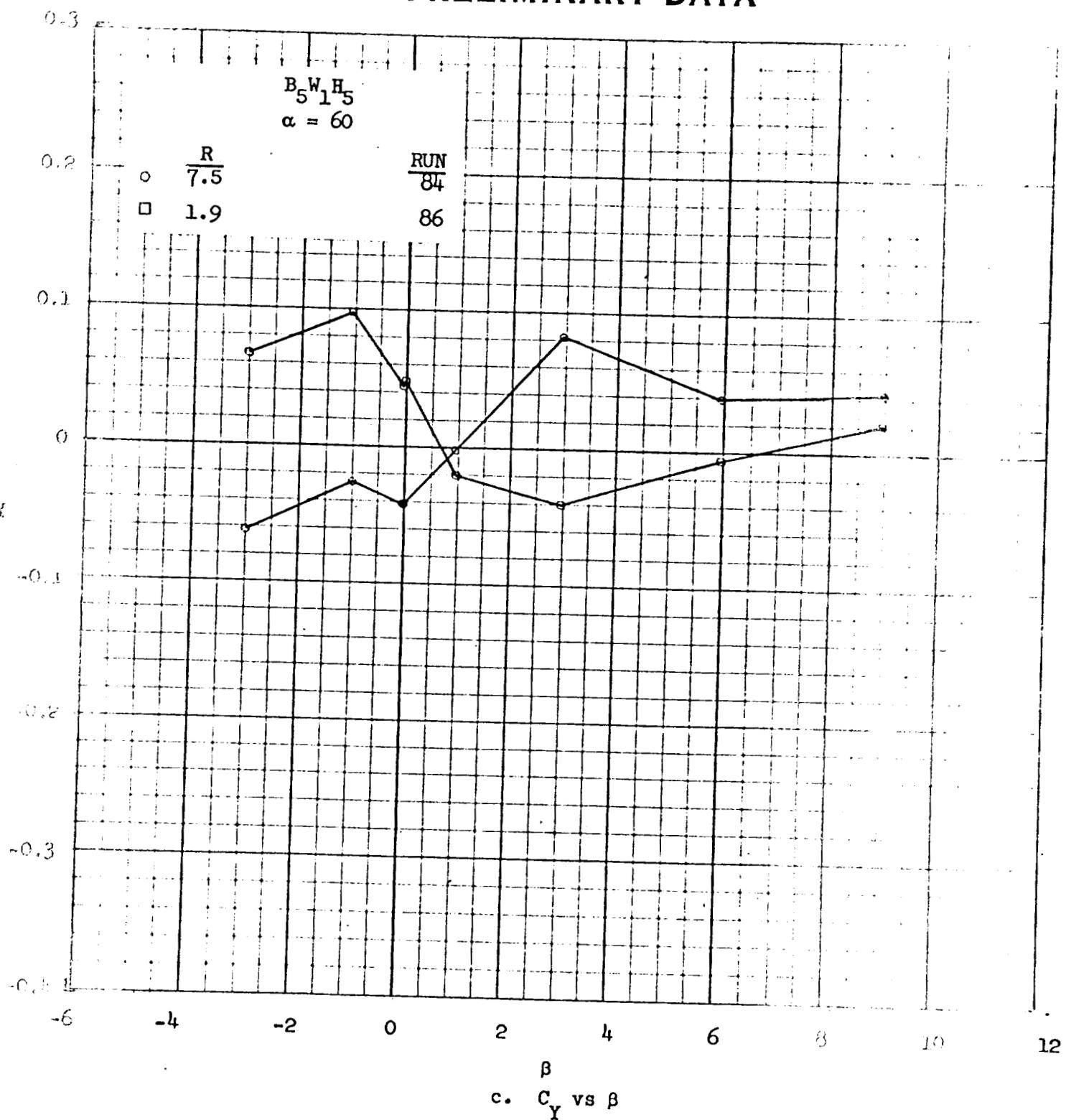


Figure 43. - concluded

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Ames Research Center: MOFFETT FIELD, CALIF.

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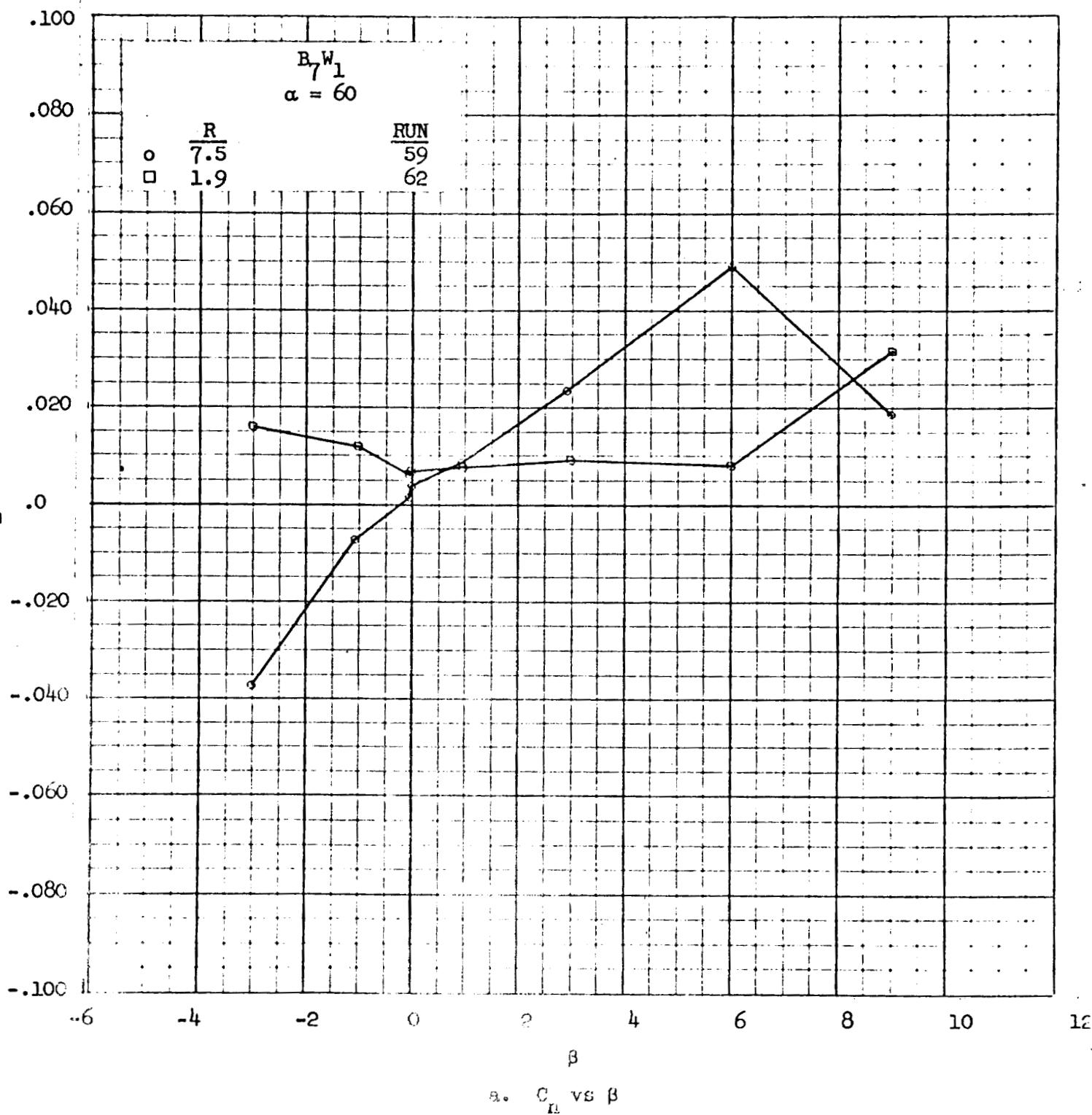


Figure 44. - Effect of sideslip angle on lateral characteristics at various Reynolds numbers for several model configurations, $\alpha = 60$ degrees, B_7W_1 .

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Ames Research Center: MOFFETT FIELD, CALIF.

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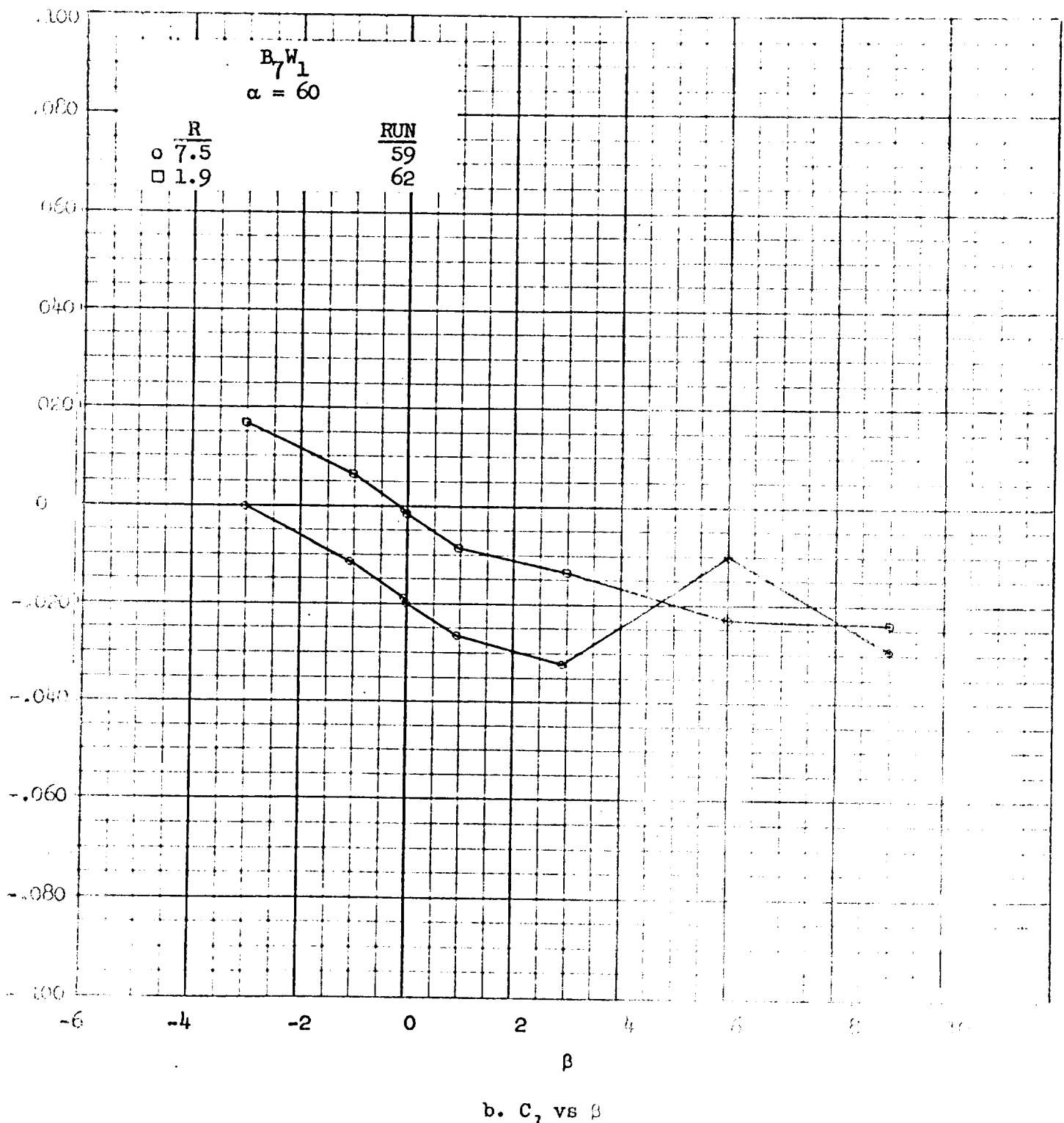


Figure 44. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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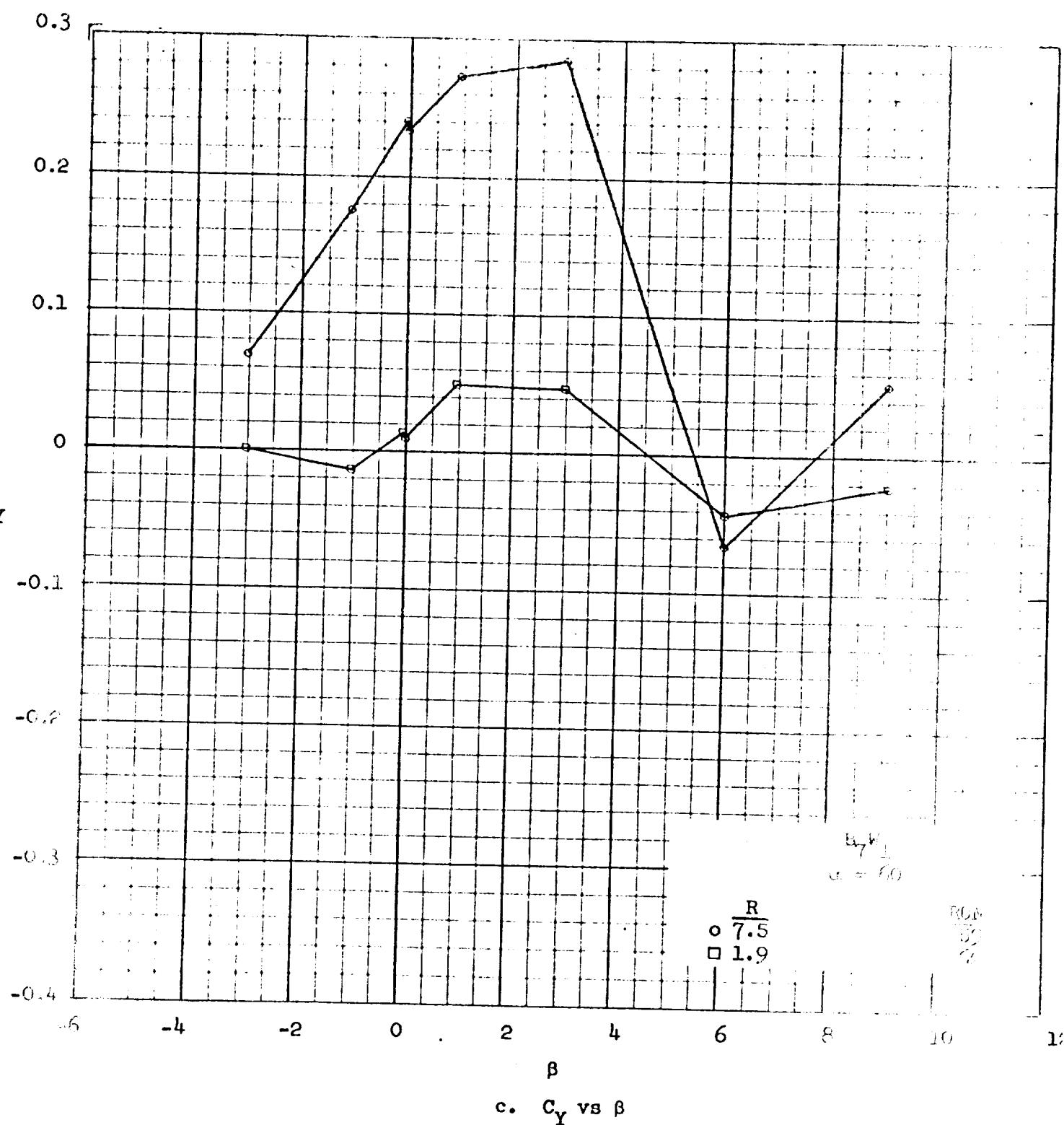


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Ames Research Center: MOFFETT FIELD, CALIF.

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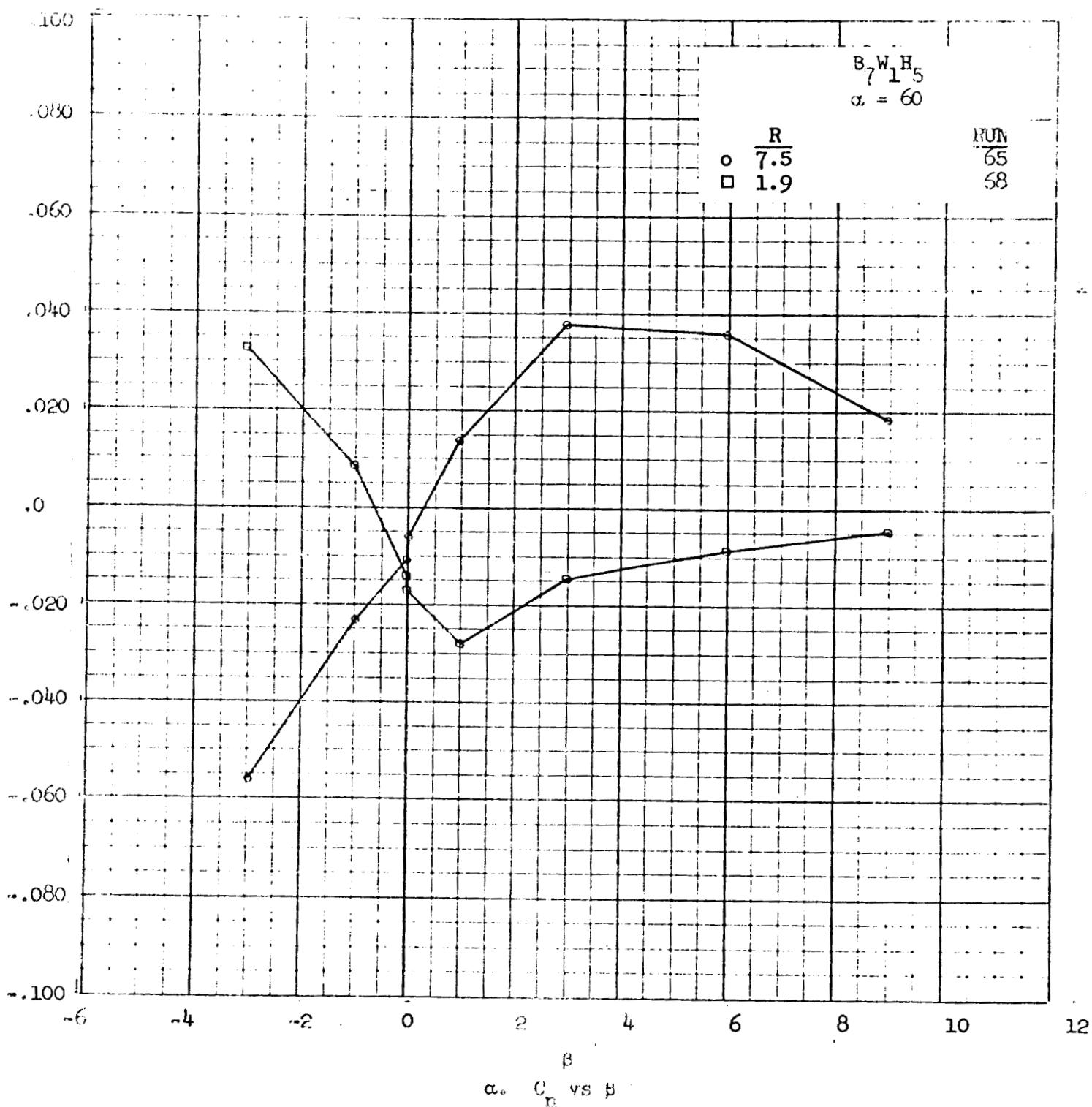


Figure 45. - Effect of sideslip angle on lateral characteristics at various Reynolds numbers for several model configurations, $\alpha = 60$ degrees, $B_7 W_1 H_5$.

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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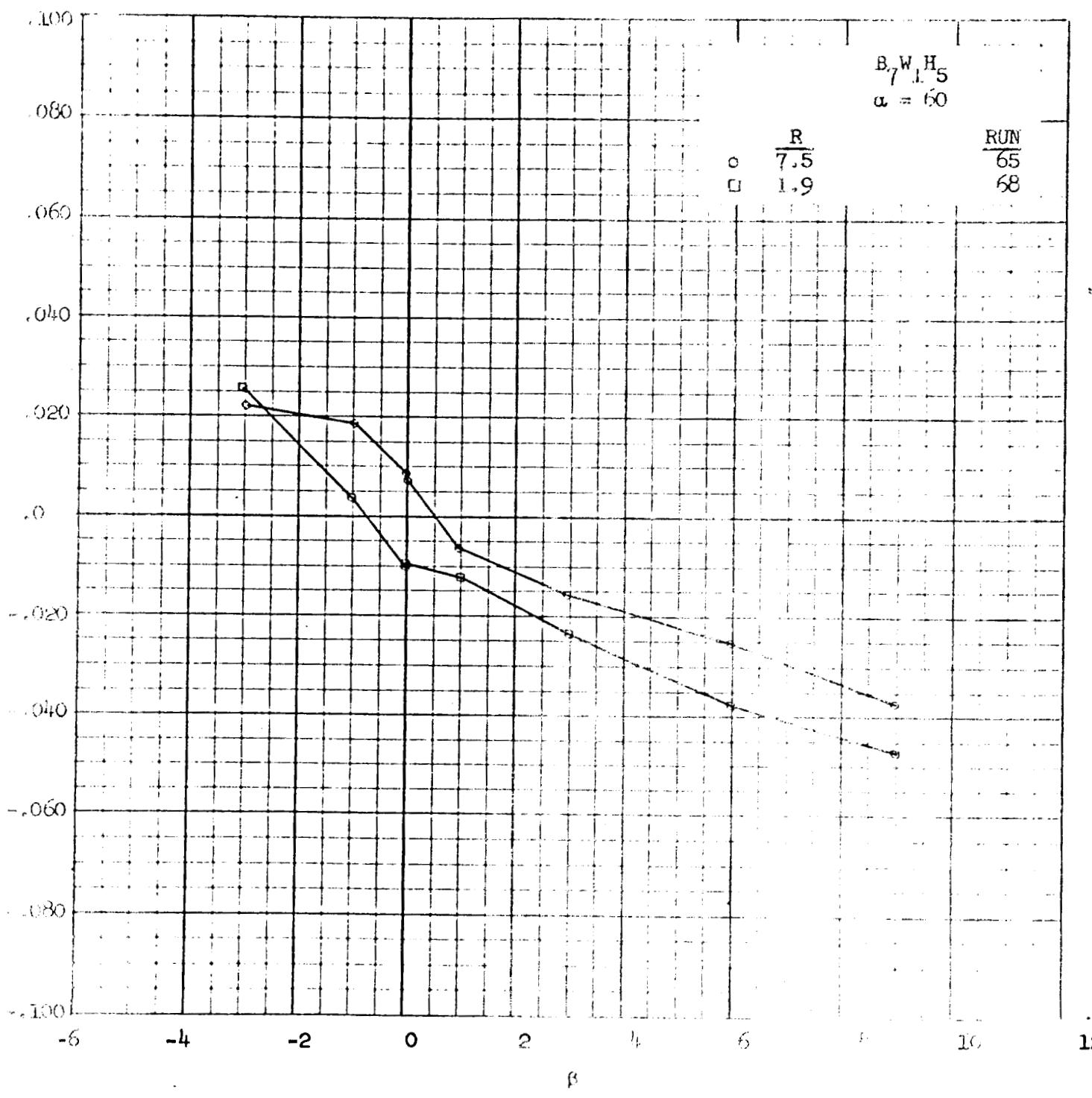


Figure 45. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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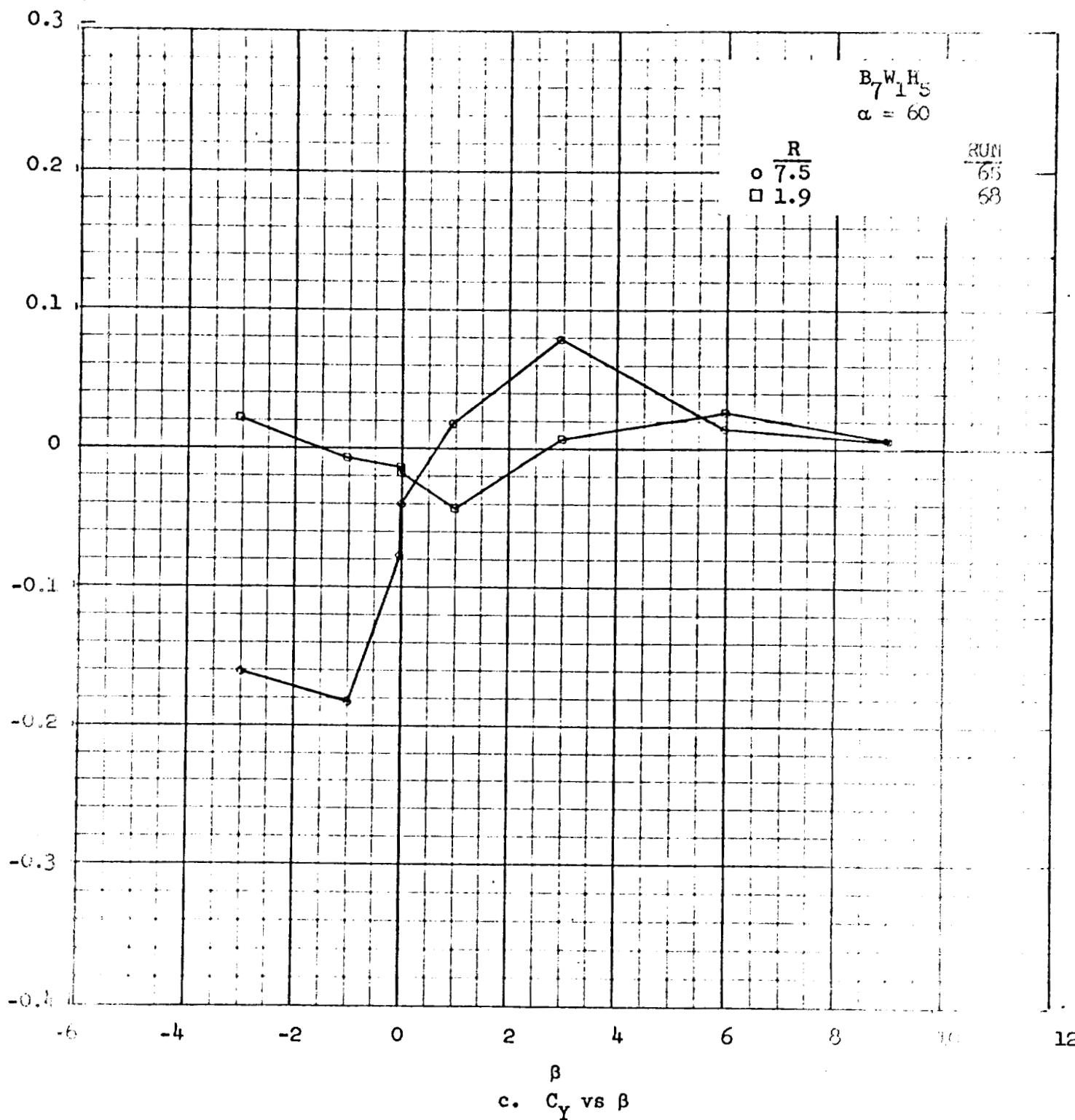


Figure 45. - concluded

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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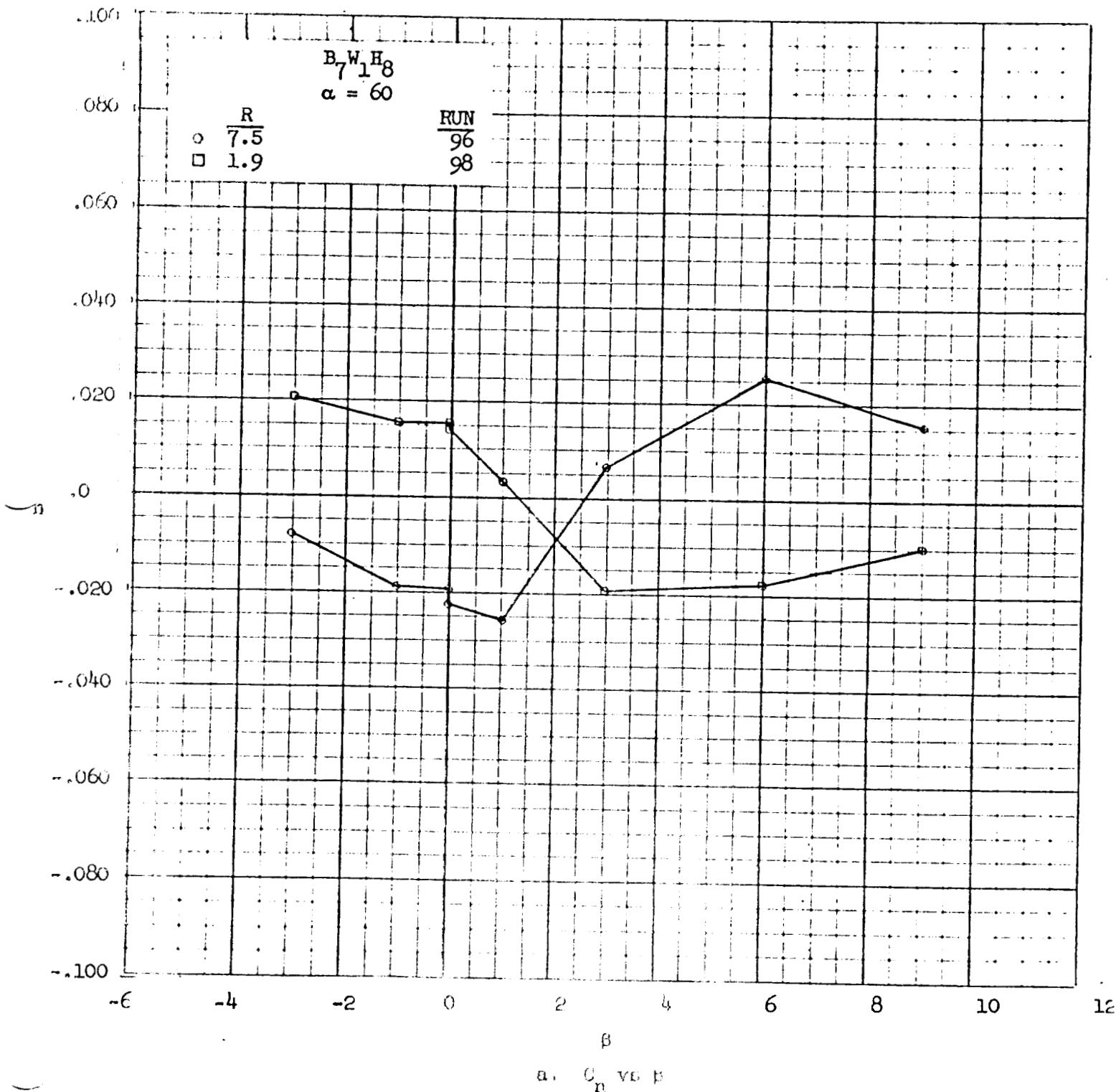
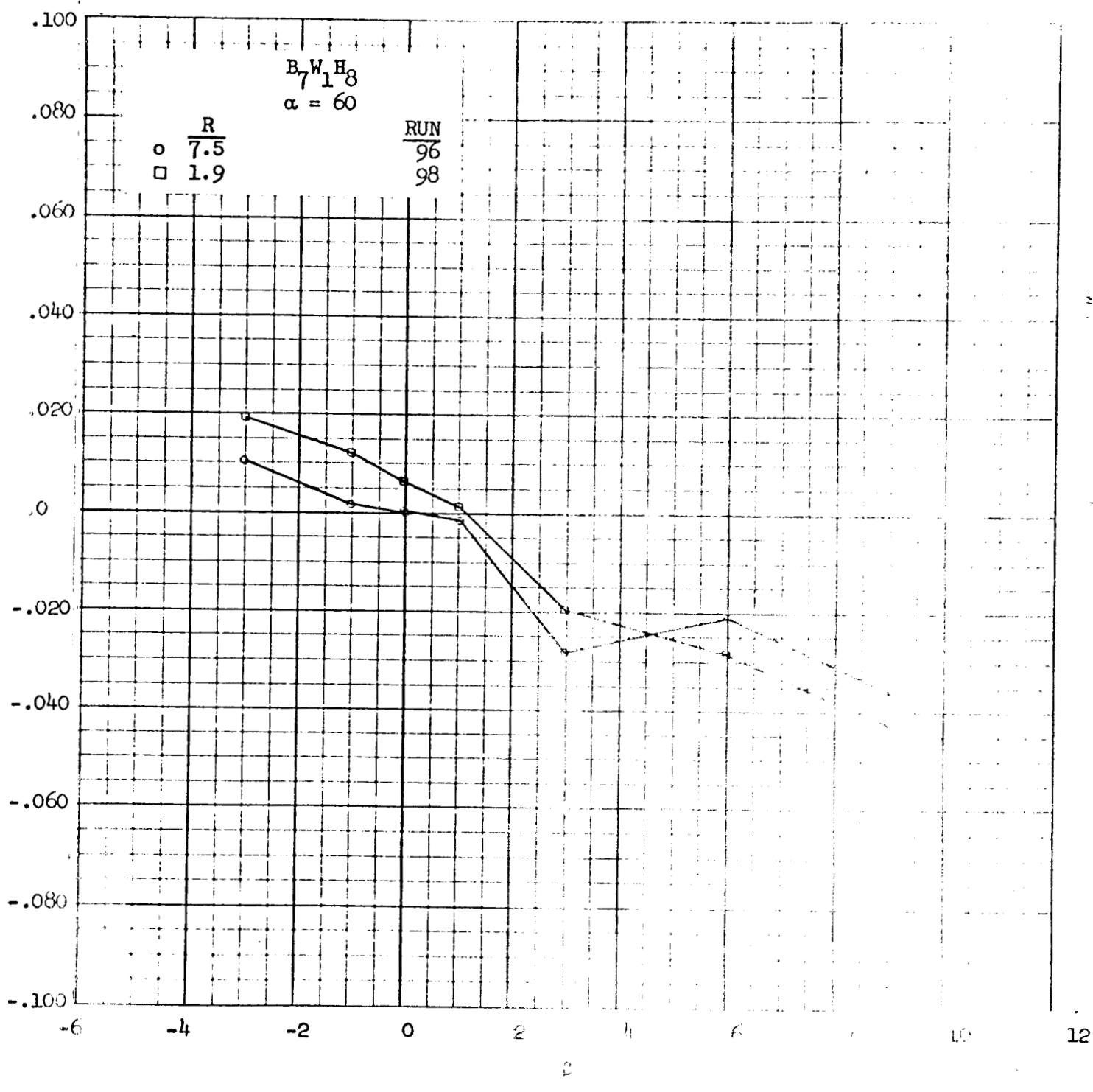


Figure 46. - Effect of sideslip angle on lateral characteristics at various Reynolds numbers for several model configurations, $\alpha = 60$ degrees, $B.W.H_8$.

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



b. C_d vs S

Figure 46. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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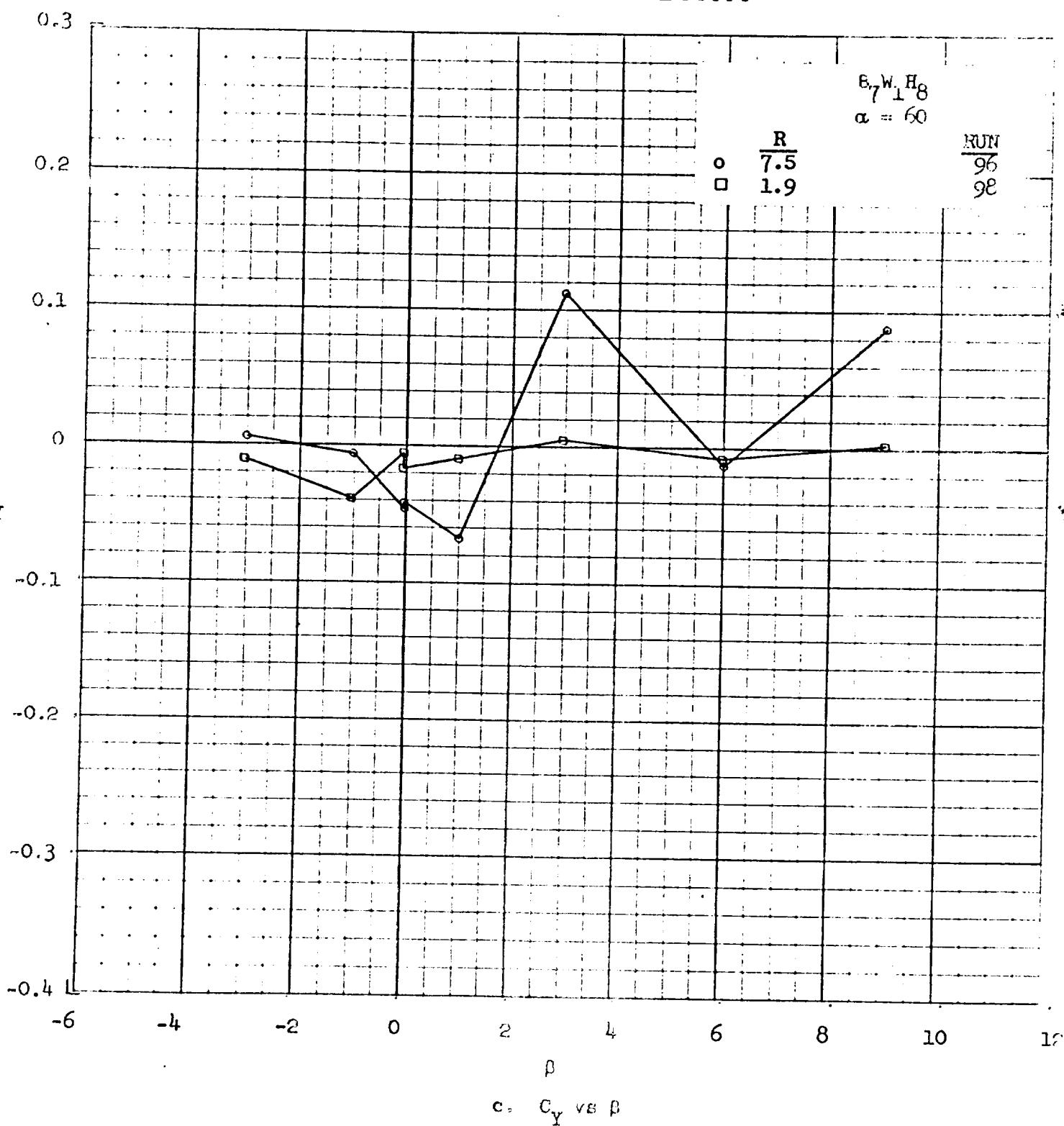


Figure 46. - concluded

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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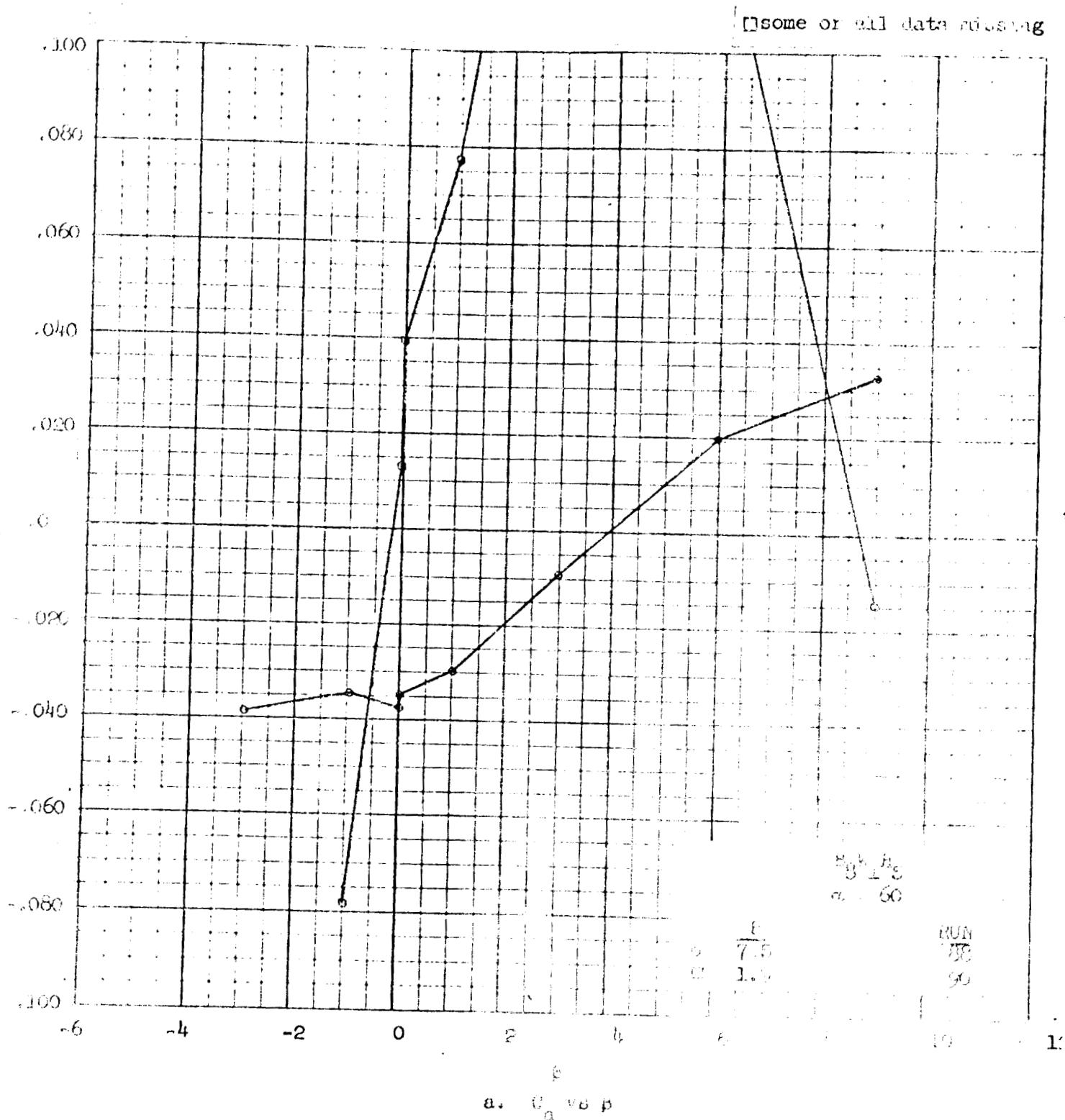
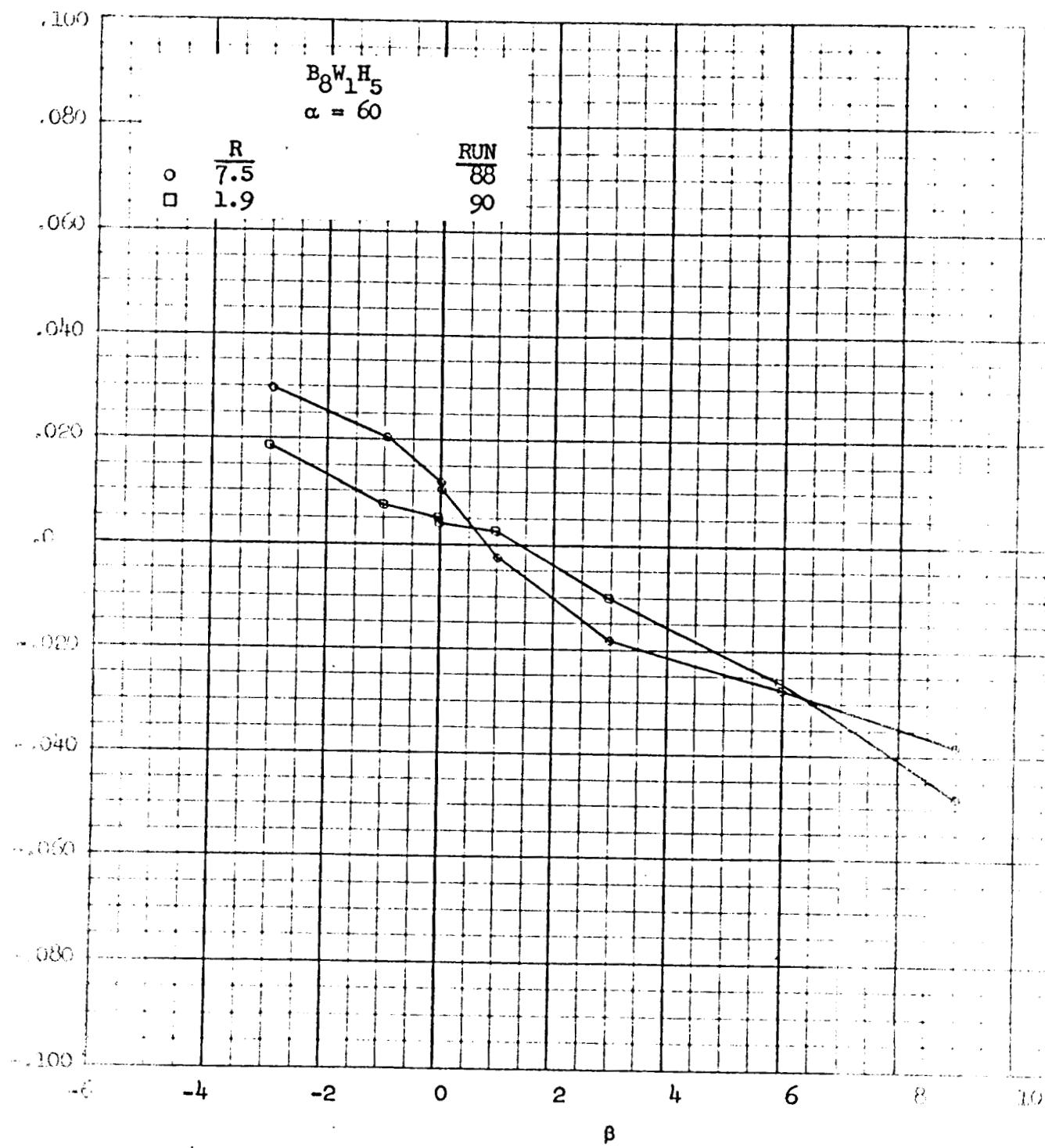


Figure 47. - Effect of sideslip angle on lateral character ratio for various Reynolds numbers for several model configurations. $\alpha = 60$ degrees, $B_R W_1 H_5$.

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.
PRELIMINARY DATA



b. C_l vs β

Figure 47. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA

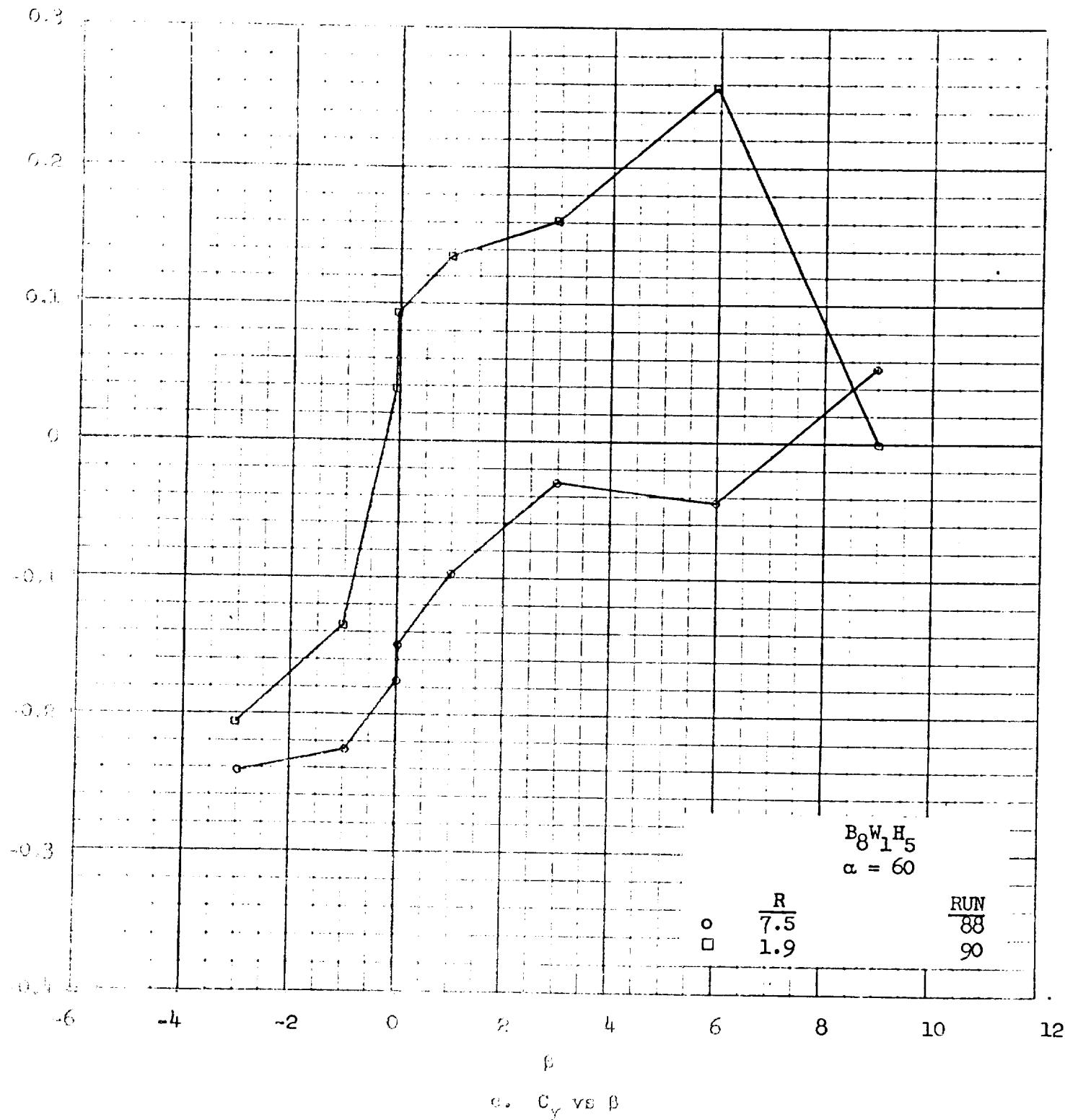
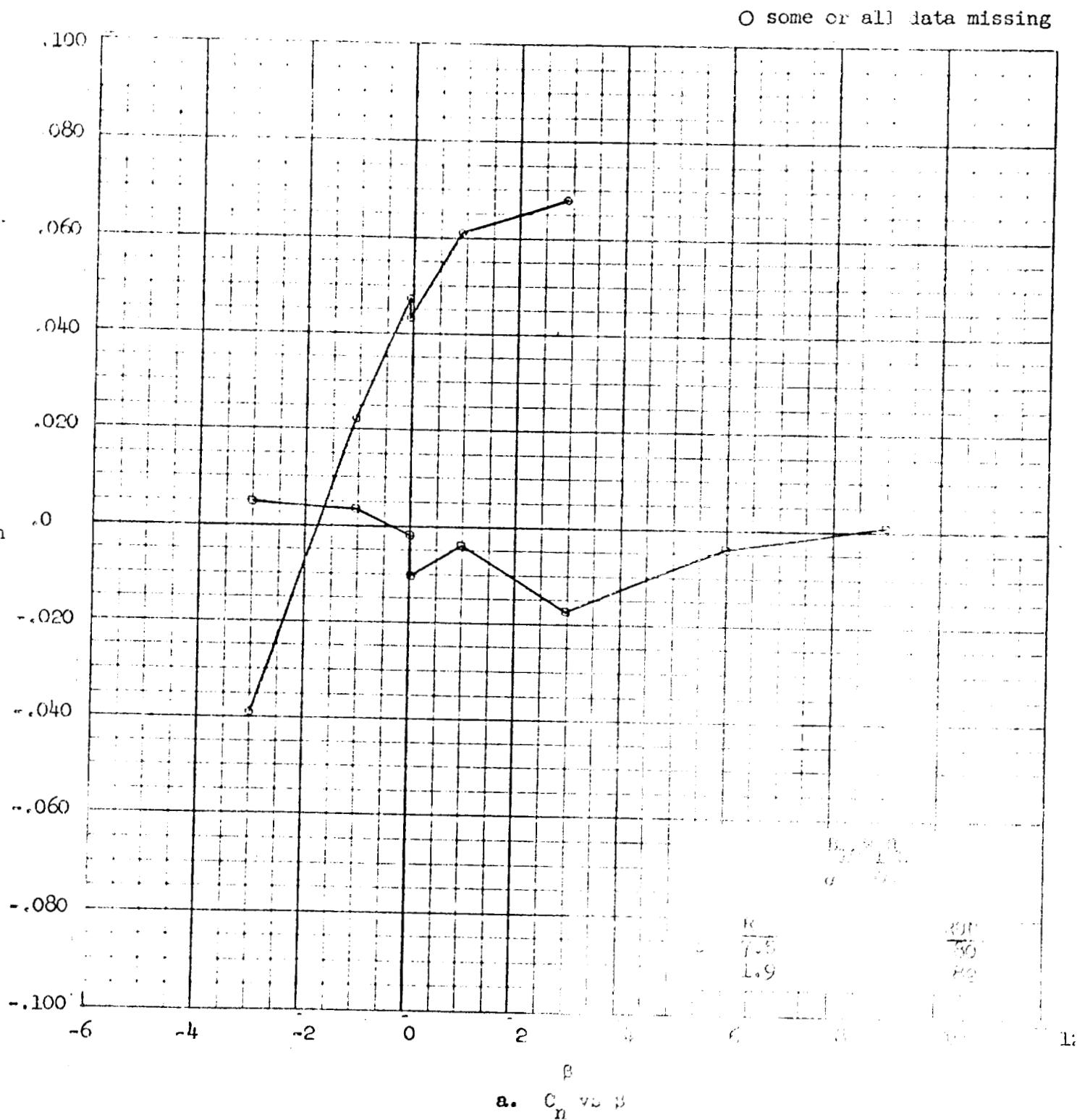


Figure 47. - concluded

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA

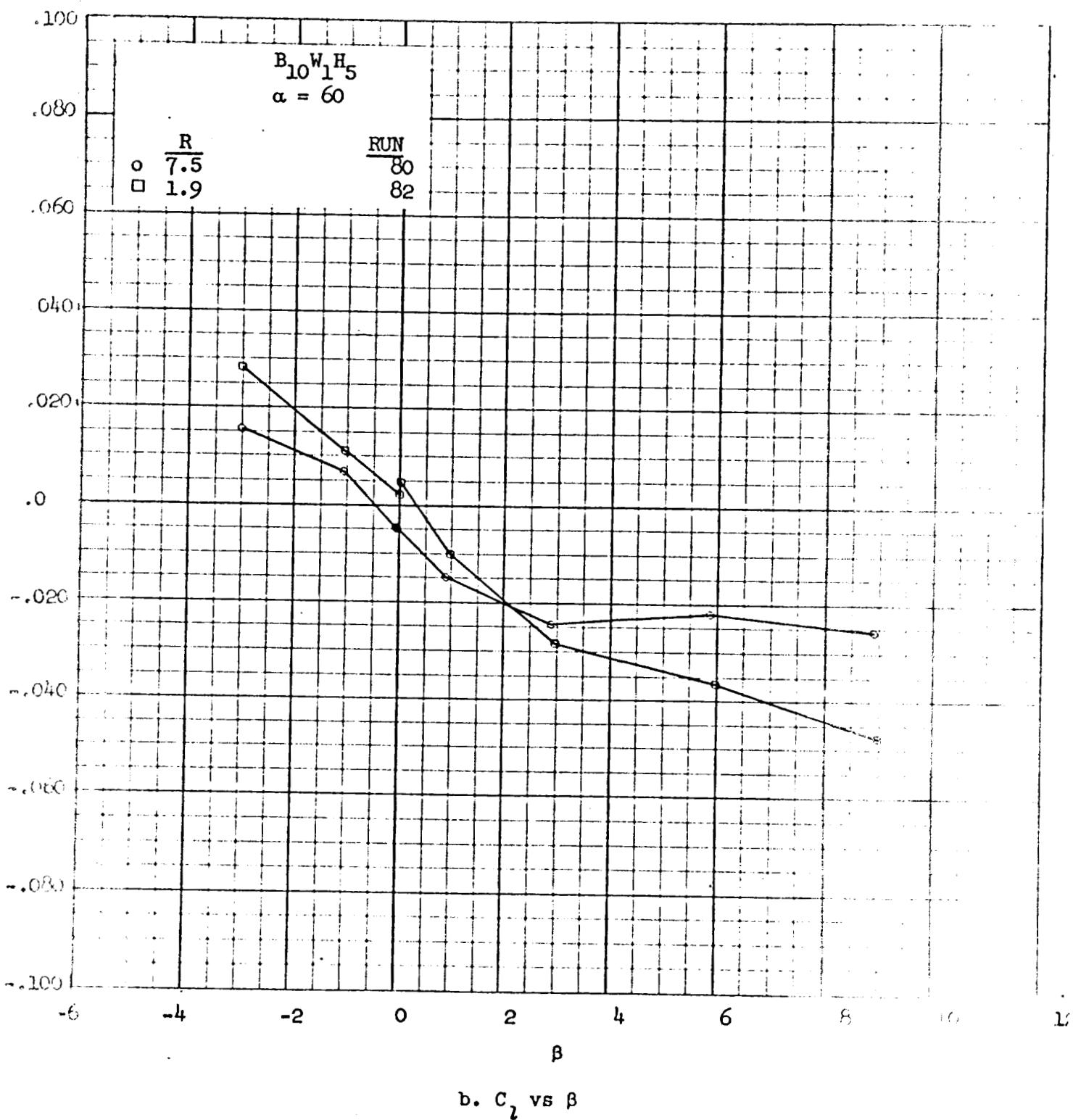


Figure 48. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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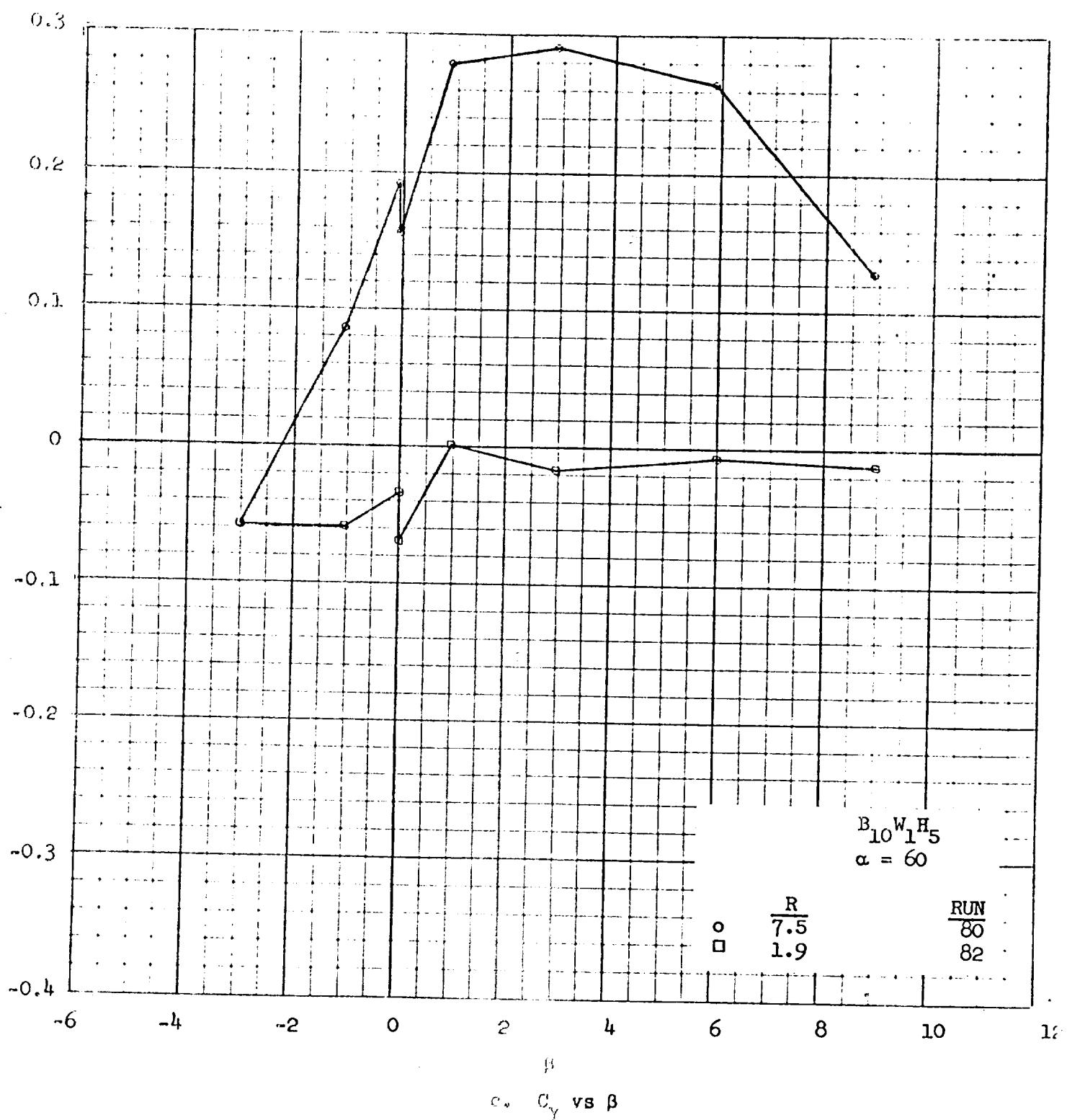


Figure 48. - concluded

National Aeronautics and Space Administration
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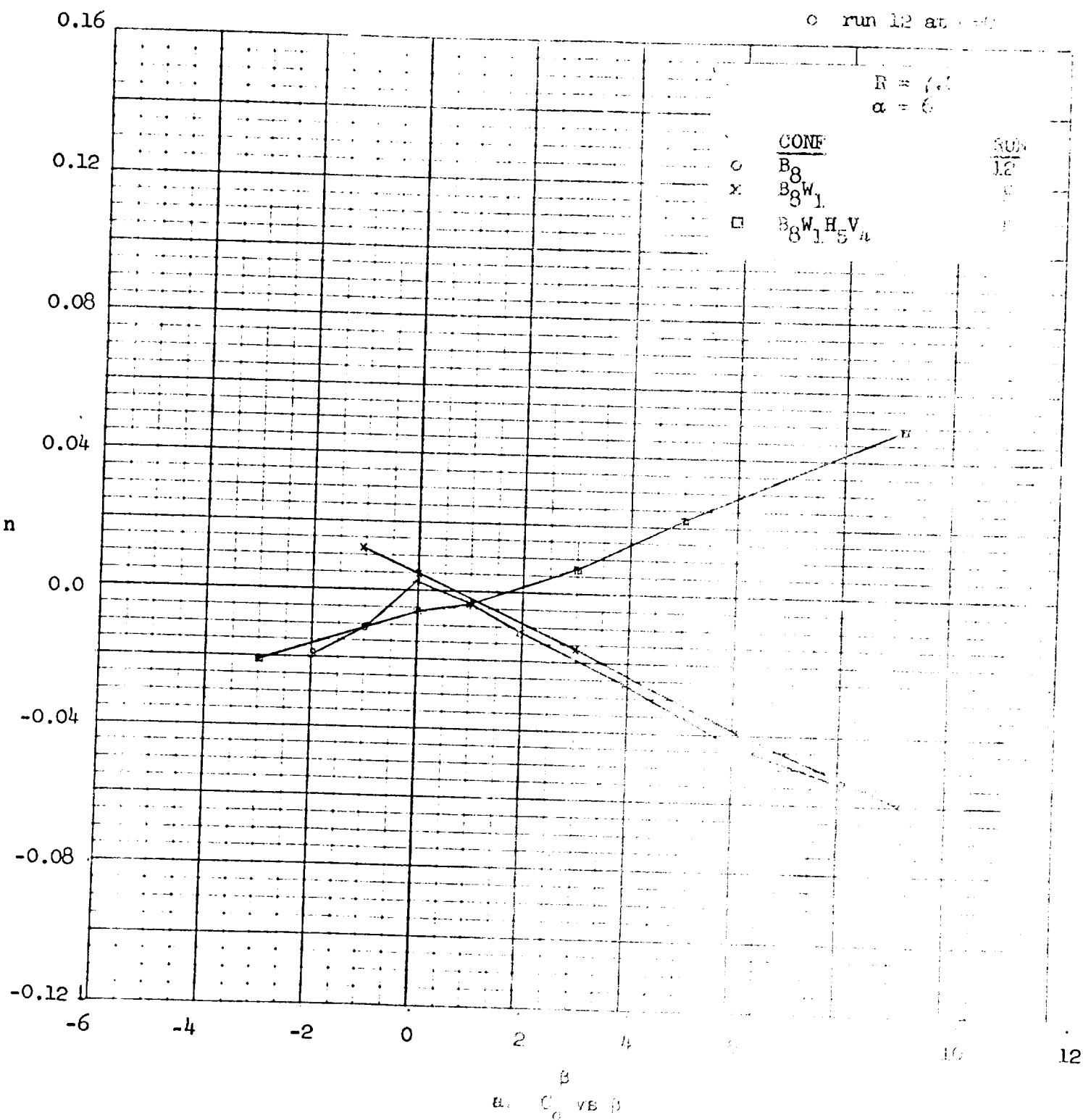
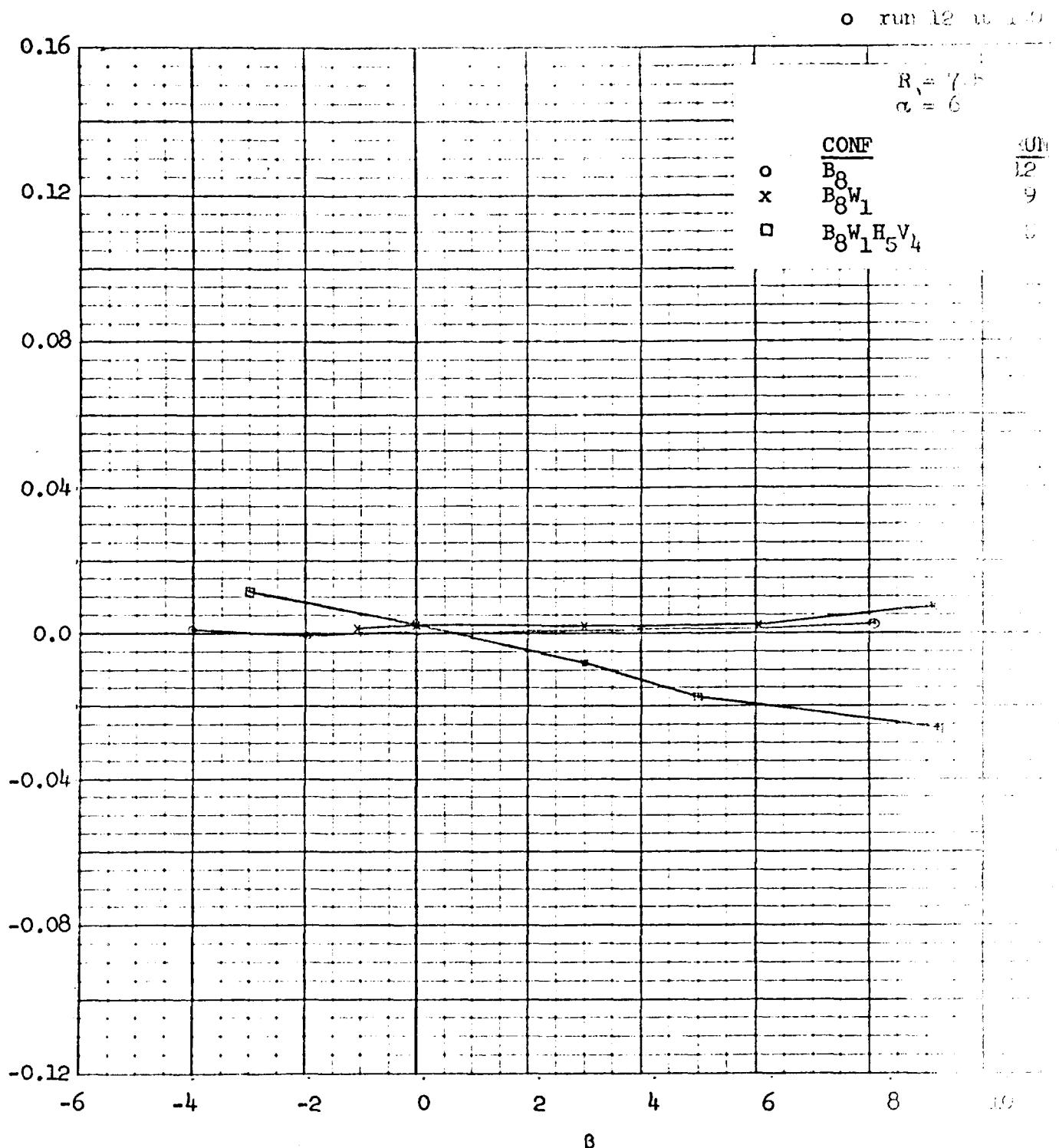


Figure 49. - Effect of sideslip angle on lateral coefficient C_n versus sideslip angle β for configuration B_8 with body B_8 , $\alpha = 6$ degrees, $R = 7.1$.

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



b. C_l vs β

Figure 49. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

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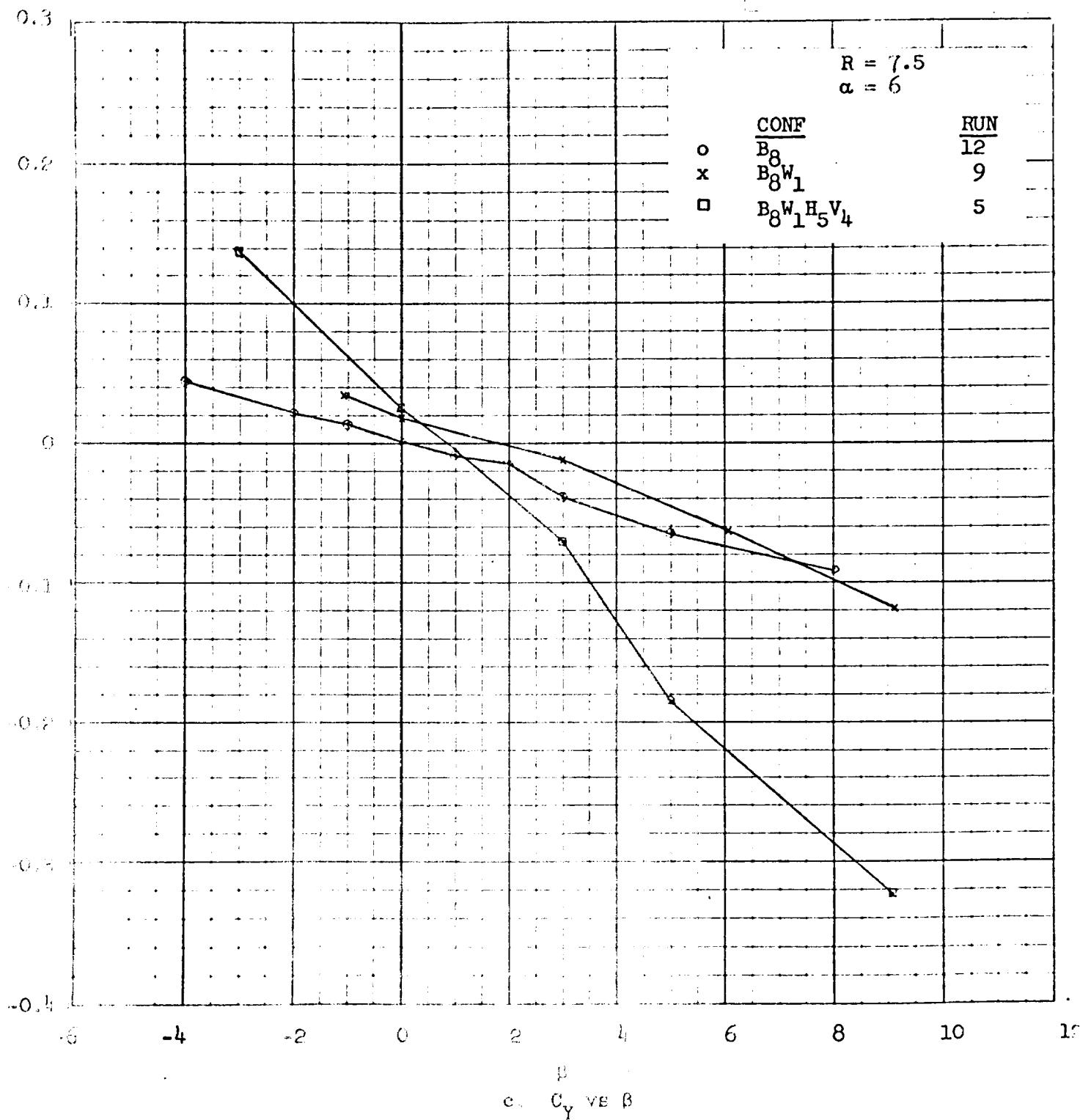


Figure 49. - concluded

National Aeronautics and Space Administration
AMES RESEARCH CENTER: MOFFETT FIELD, CALIF.
PRELIMINARY DATA

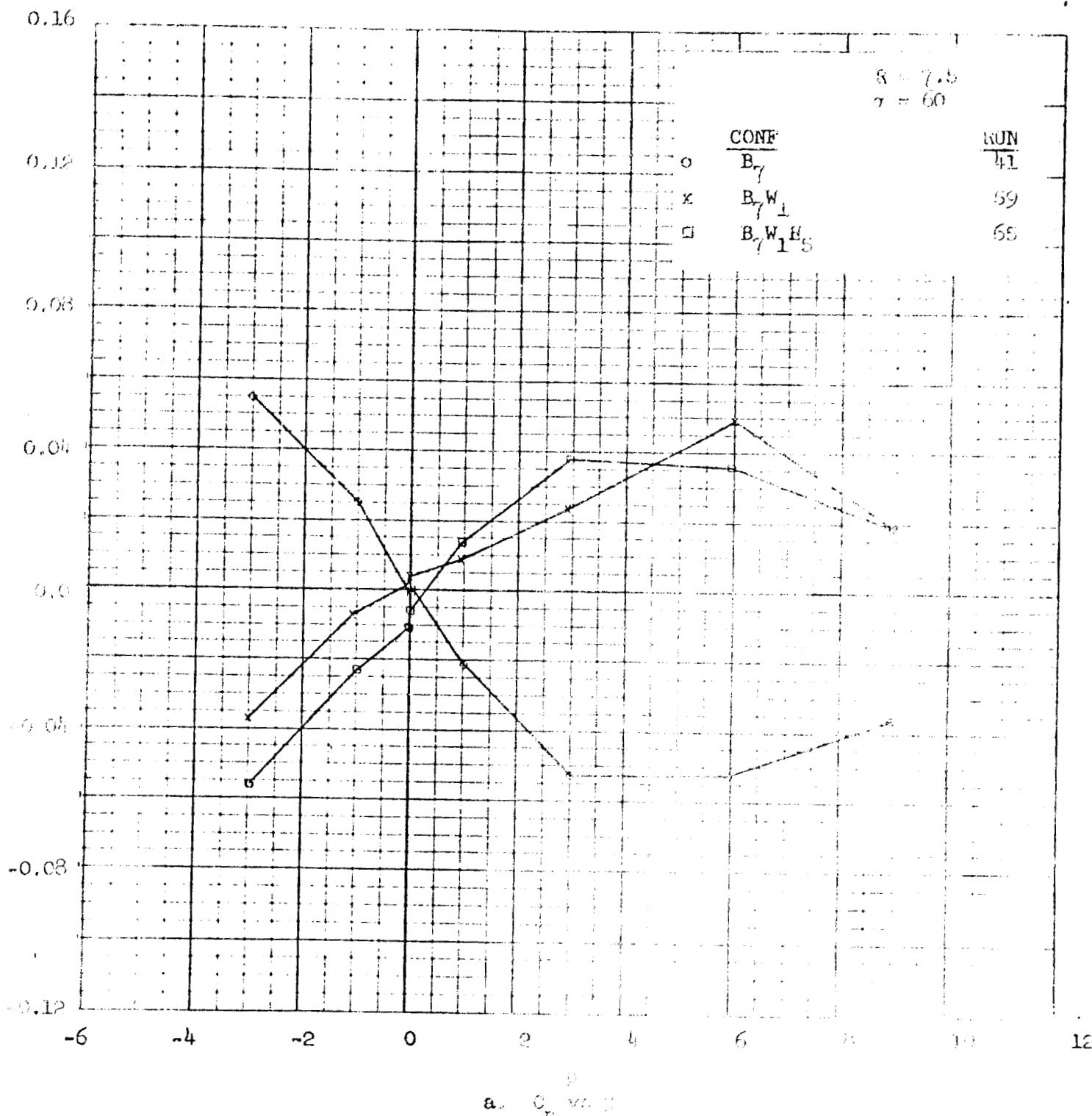
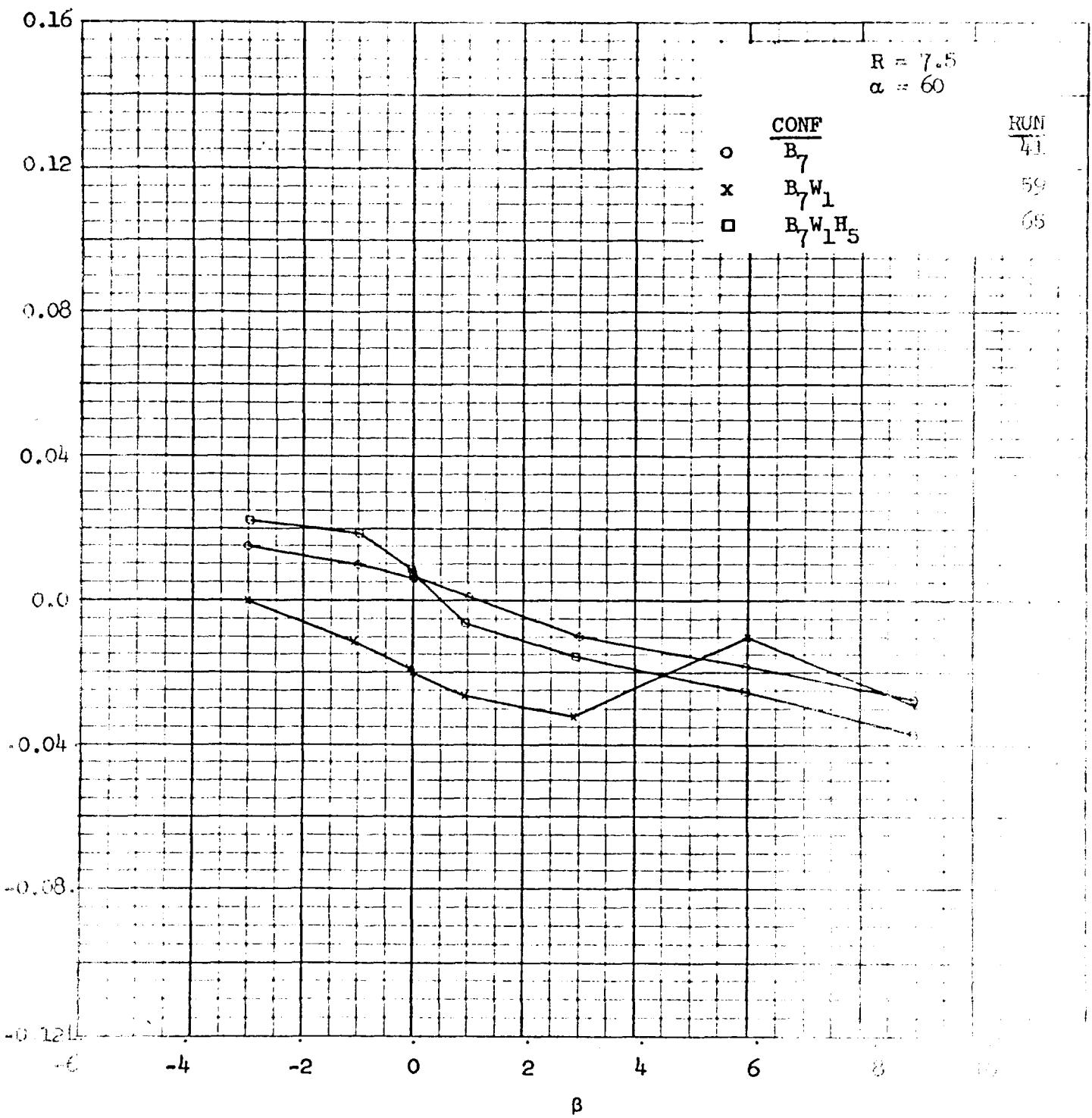


Figure 50. - Effect of sideslip angle on lateral coefficient of lift for flying model, windup,
 $\alpha = 60$ degrees, $R = 7.5$, $R_{71}E_5$.

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Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



b. C_2 vs β

Figure 50. - continued

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PRELIMINARY DATA

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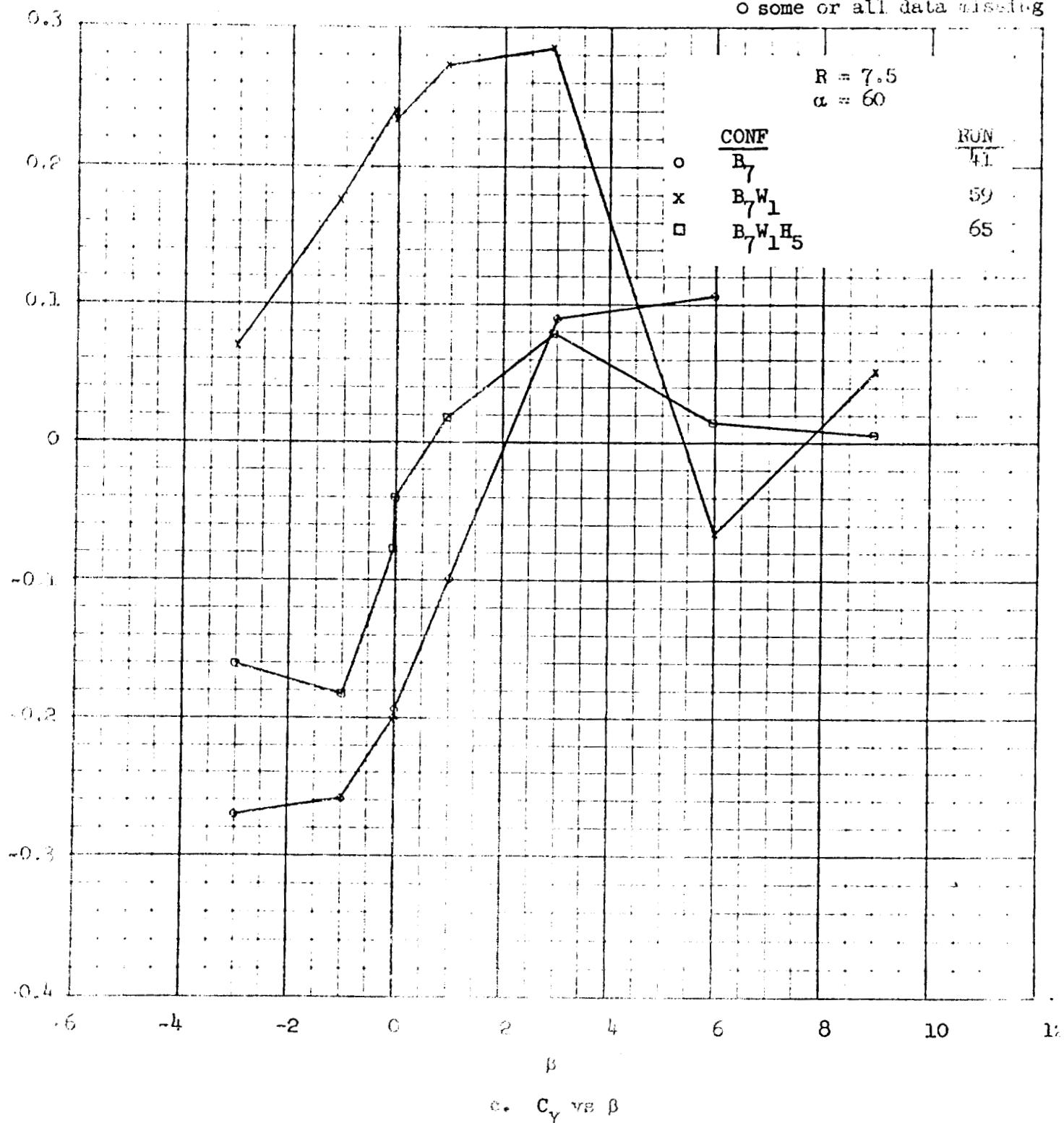


Figure 50. - concluded

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PRELIMINARY DATA

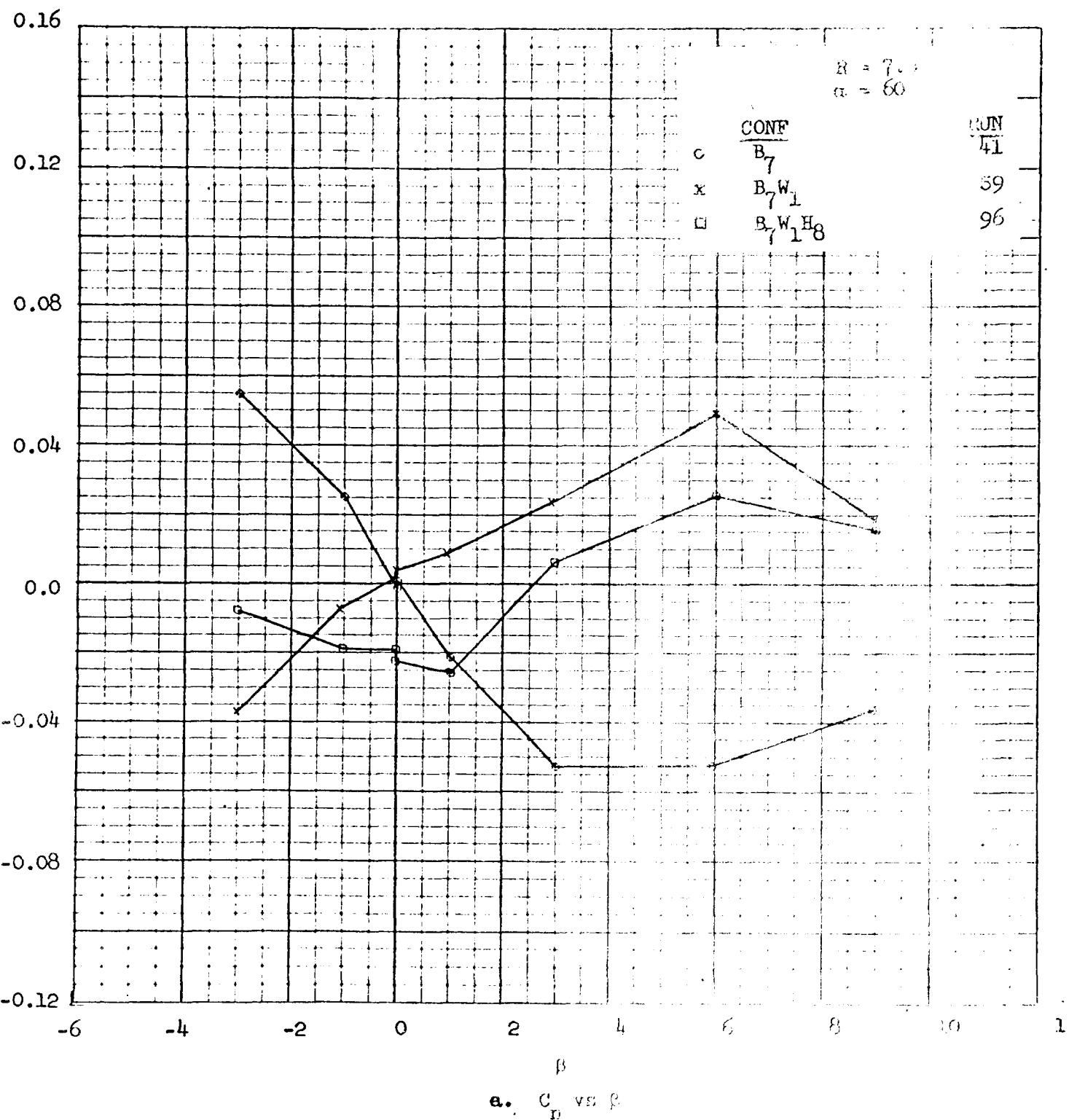


Figure 51. - Effect of sideslip angle on lateral characteristics during model buildup
 $\alpha = 60$ degrees, $R = 7.5$, $B_7W_1H_8$.

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Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA

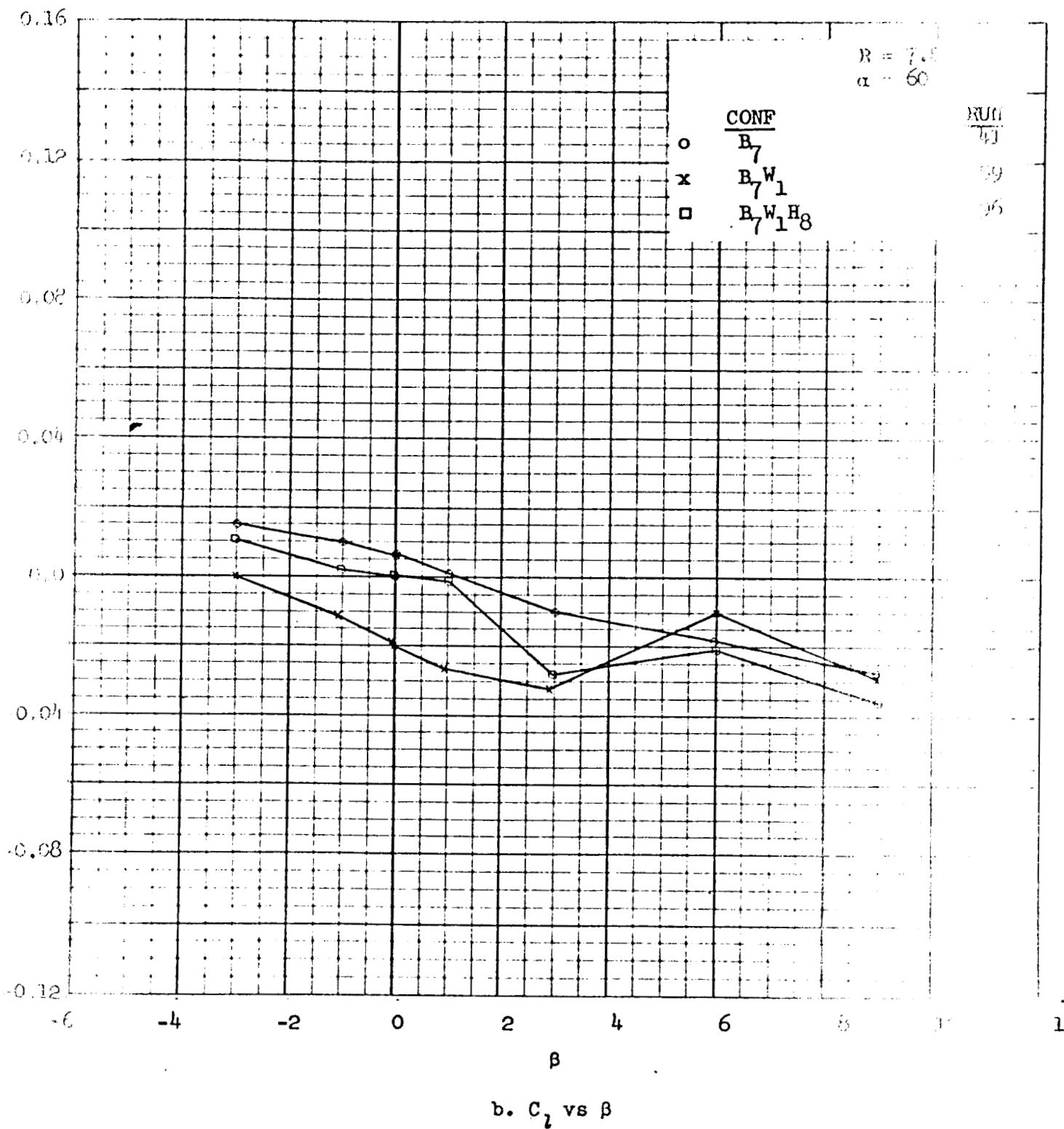


Figure 51. - continued

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PRELIMINARY DATA

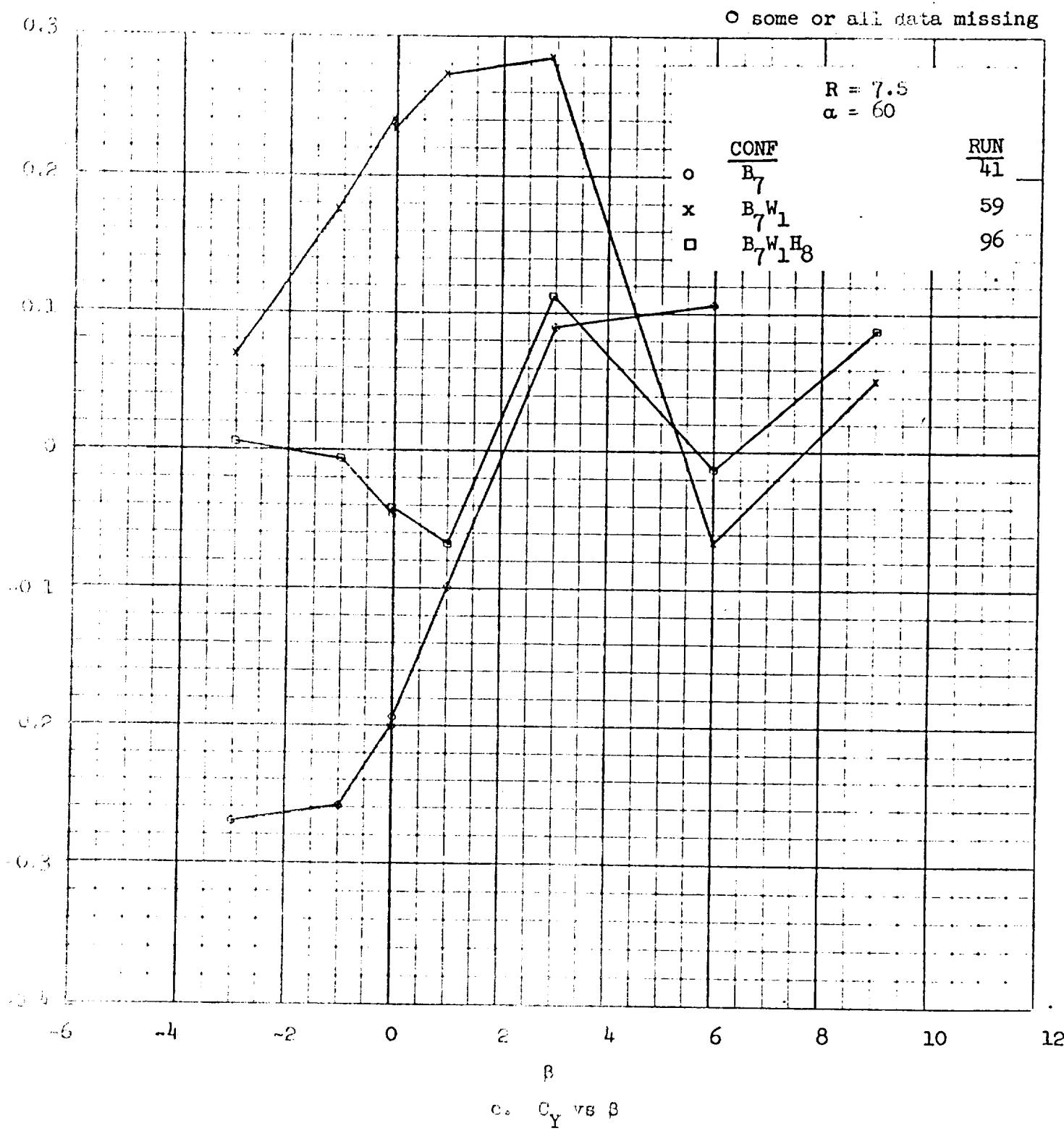


Figure 51. - concluded

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PRELIMINARY DATA

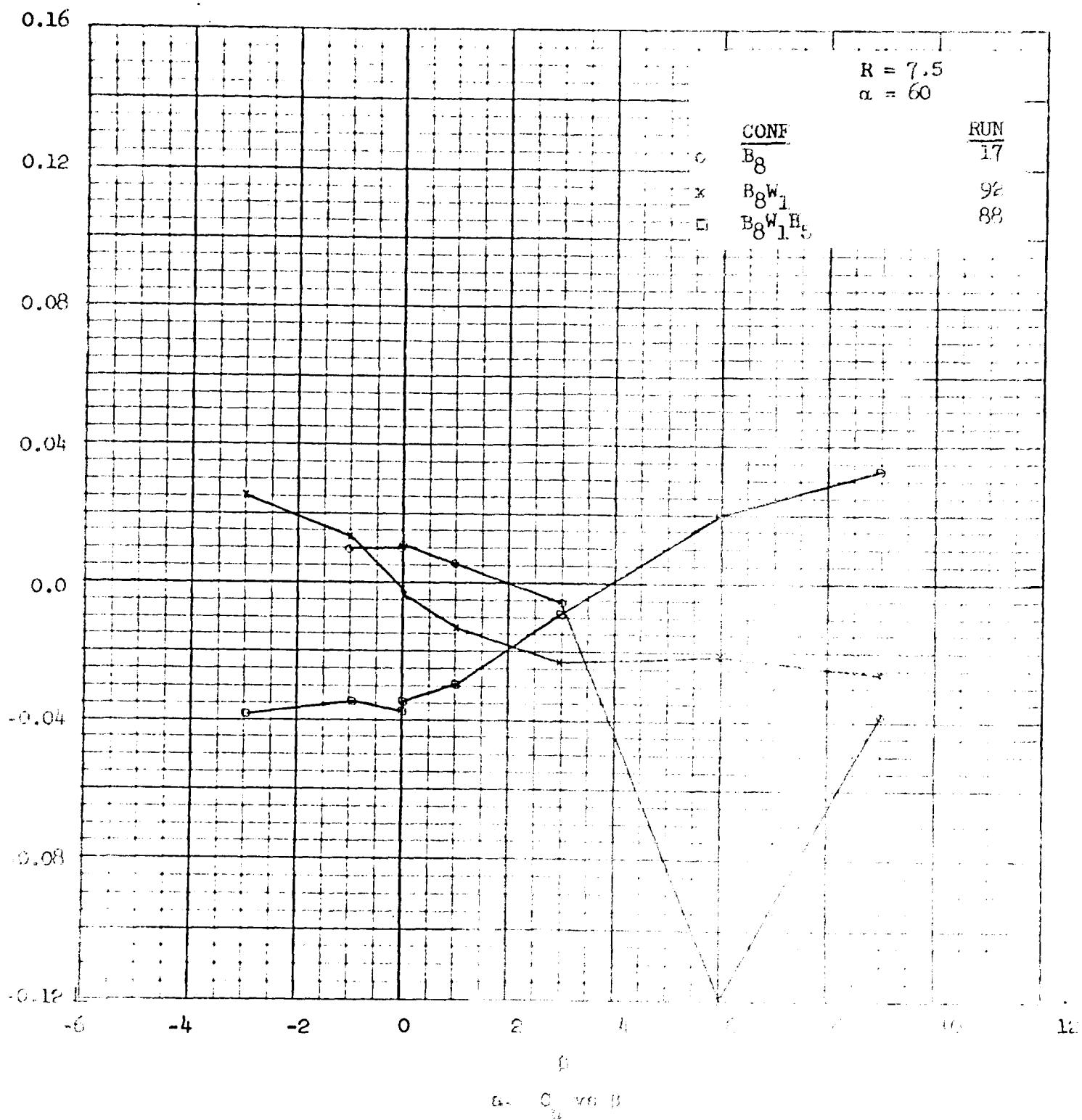
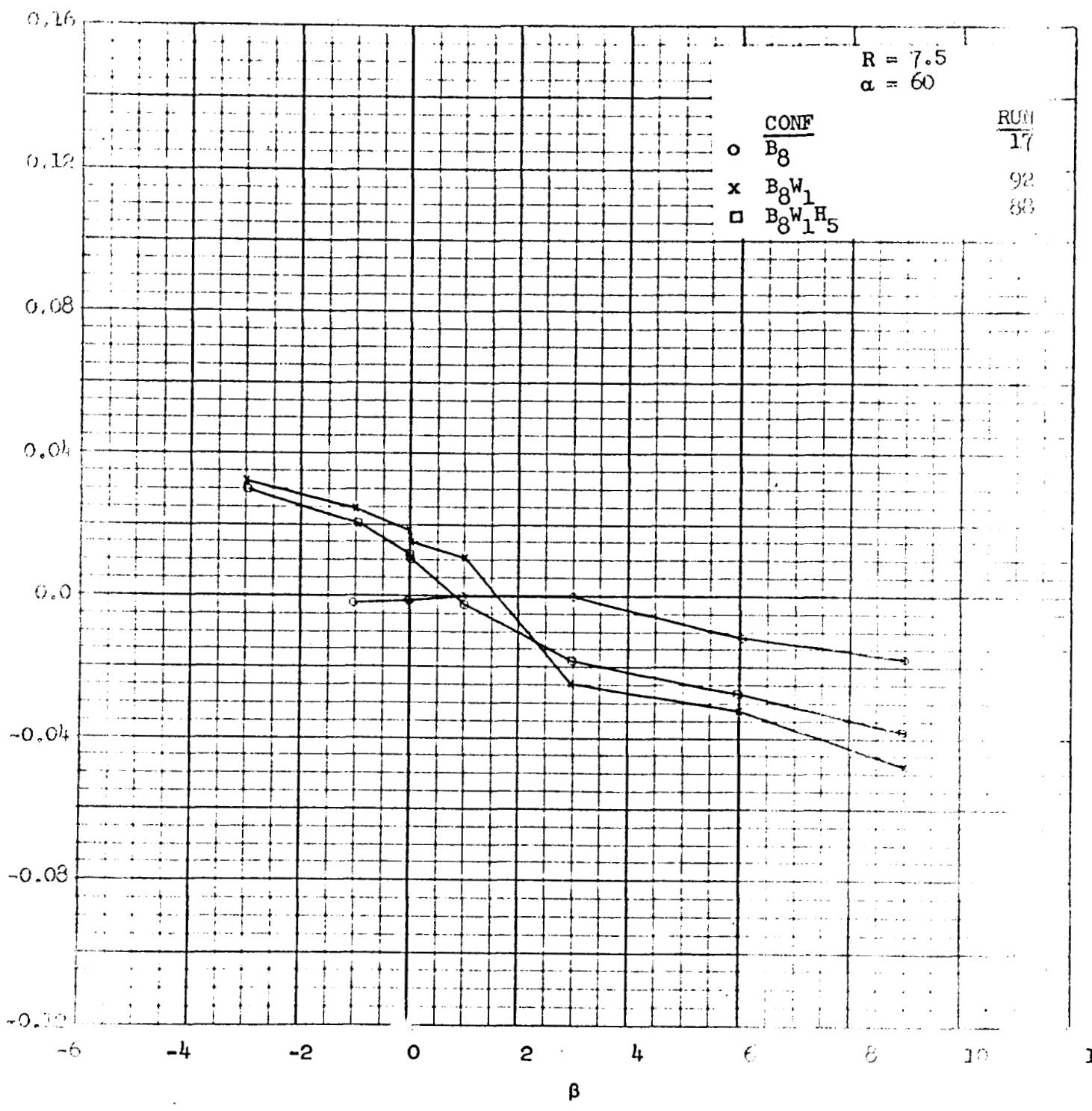


Figure 52. - Effect of sideslip angle on lateral damping coefficient during roll buildup,
 $\alpha = 60$ degrees, $R = 7.5$, $B_{8W_1H_5}$.

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Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA



b. C_l vs β

Figure 52. - continued

National Aeronautics and Space Administration
Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA

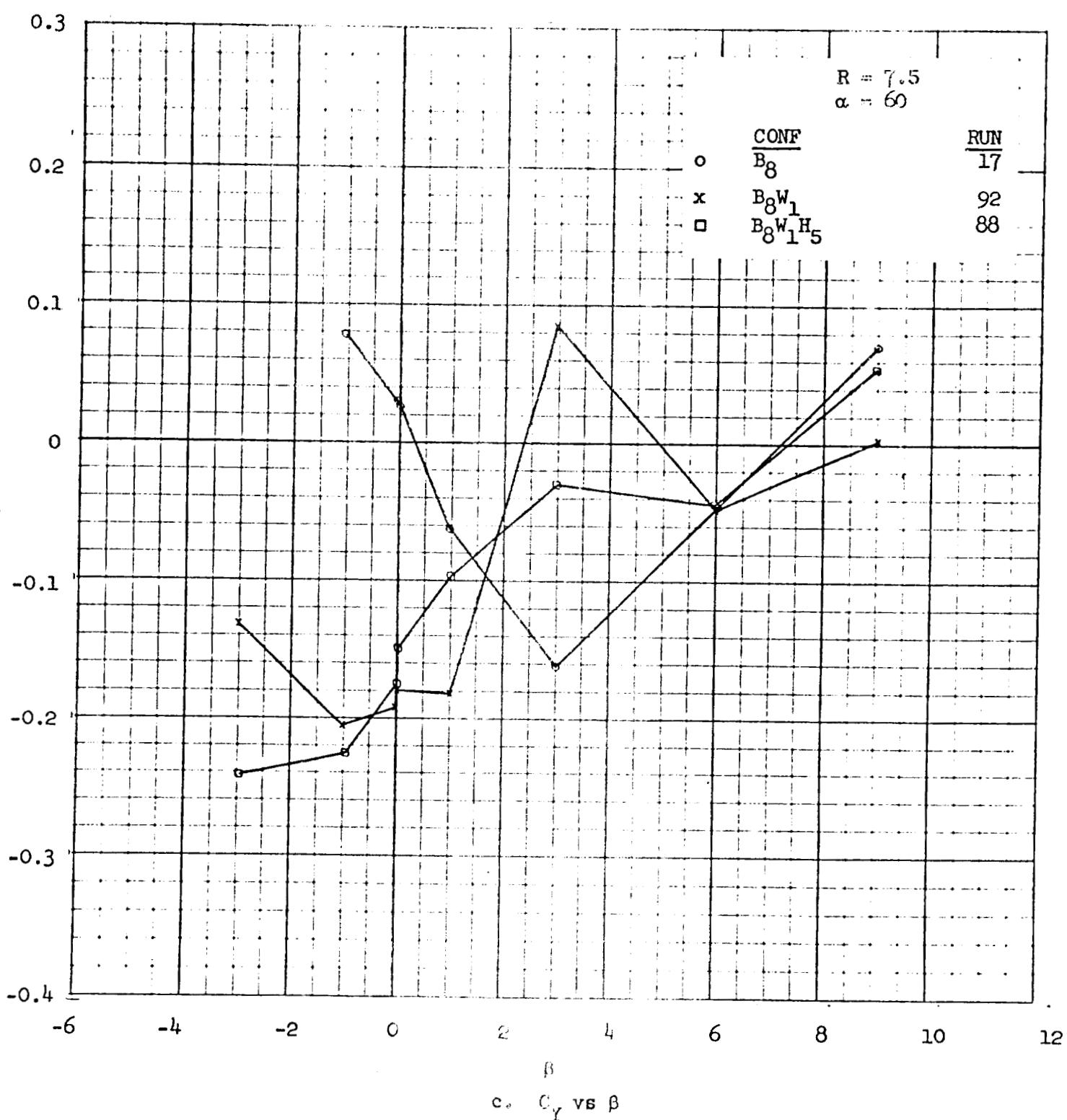


Figure 52. - concluded

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PRELIMINARY DATA

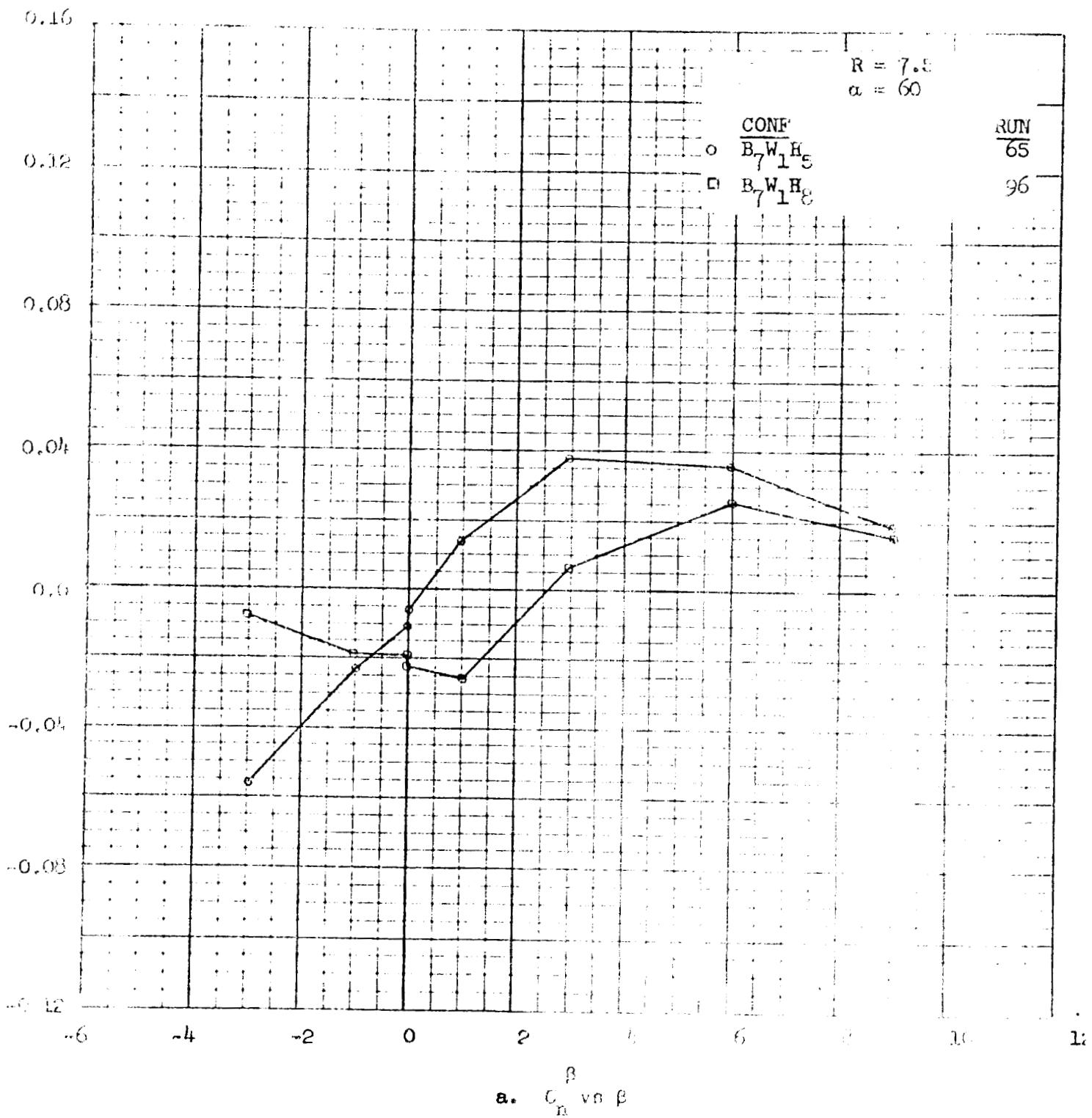


Figure 53. - Effect of sideslip angle on lateral coefficient for two horizontal stabilizer configurations with $R = 7.5$, $\alpha = 60^\circ$, $V = 60$, $M = 0.75$.

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PRELIMINARY DATA

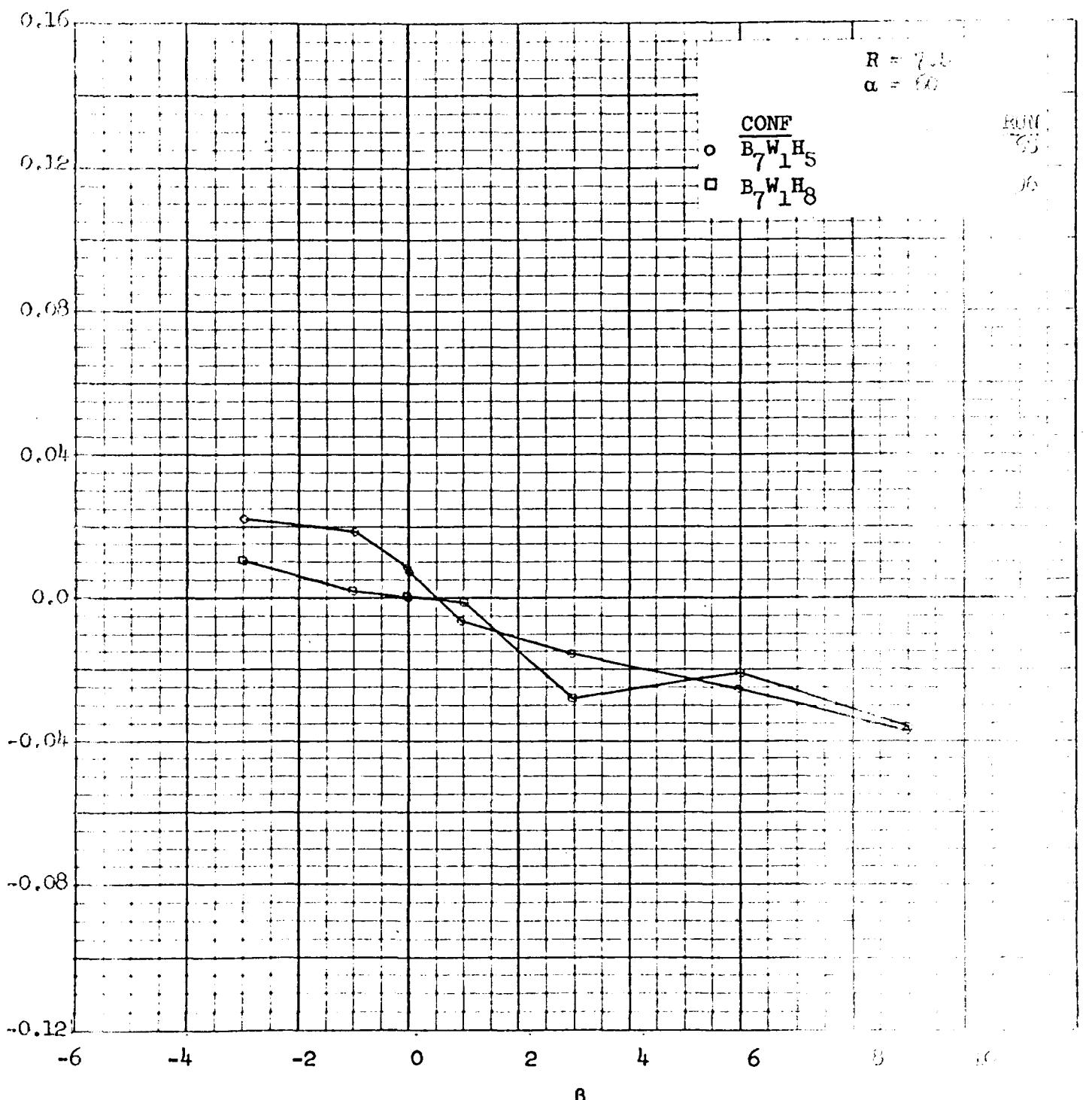


Figure 53. - continued

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PRELIMINARY DATA

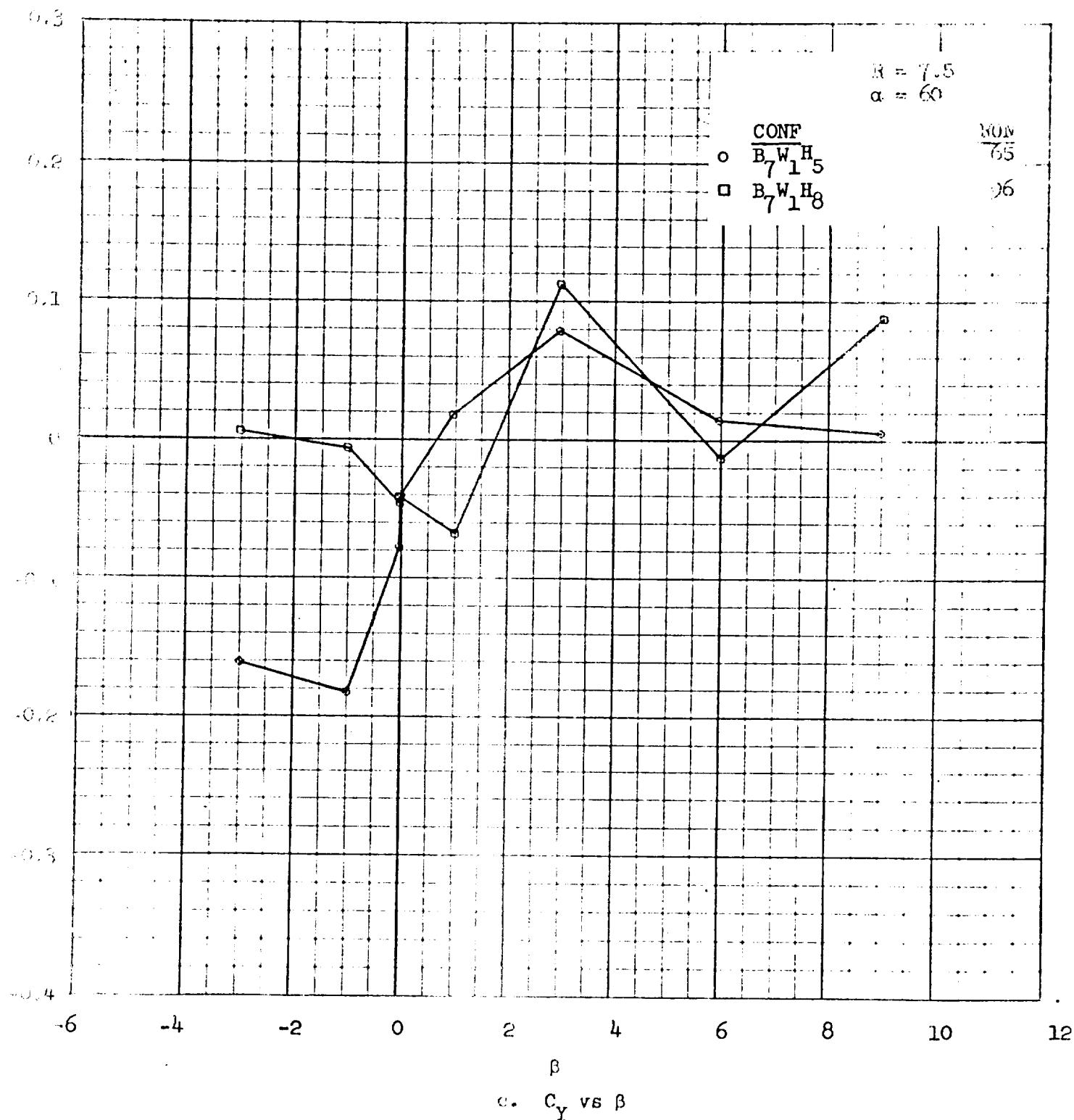


Figure 53. - concluded

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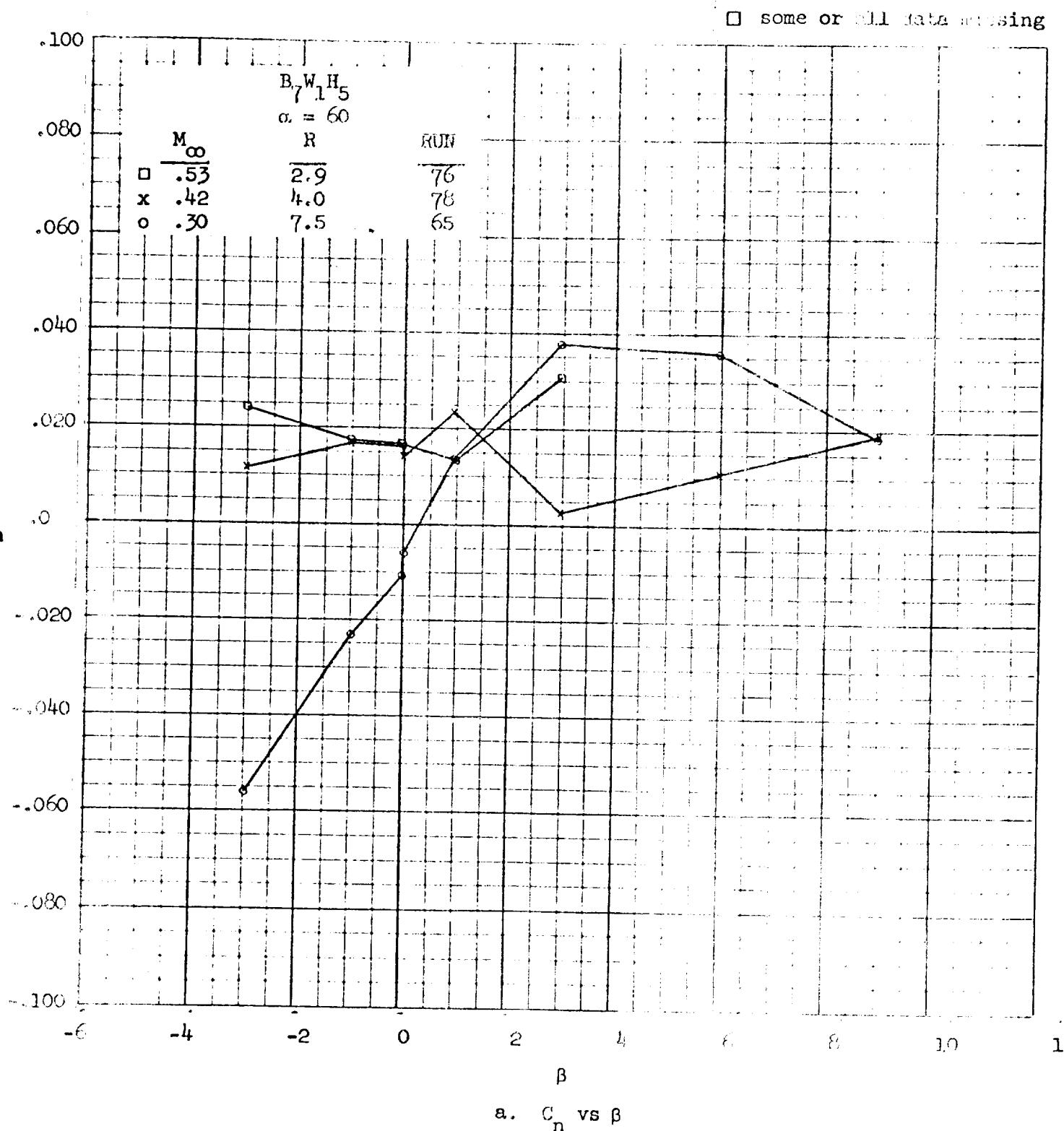


Figure 54. - Variation of lateral characteristics with roll angle.

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PRELIMINARY DATA

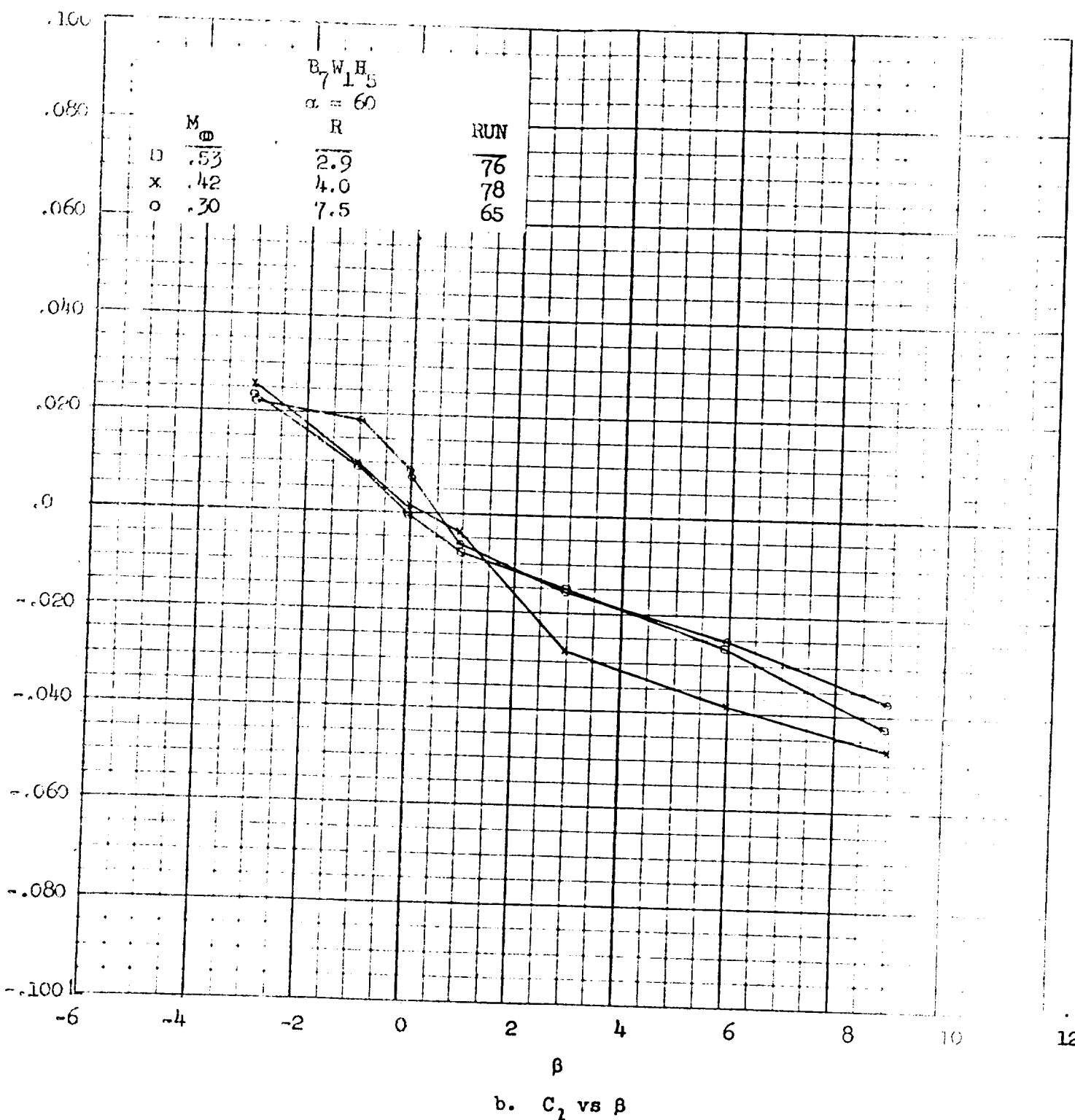


Figure 54. - Continued

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Ames Research Center: MOFFETT FIELD, CALIF.

PRELIMINARY DATA

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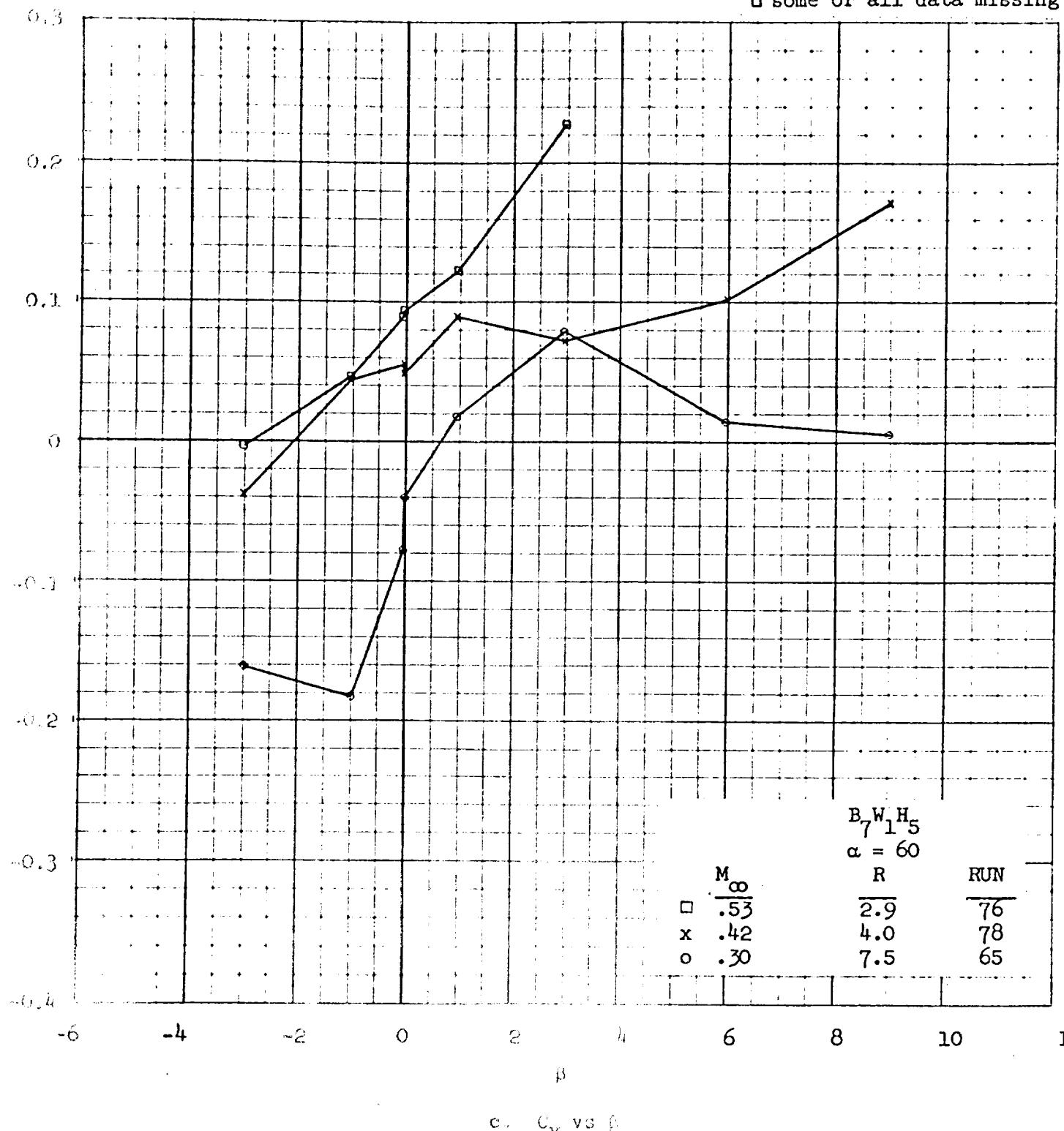


Figure 54. - Concluded